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UNRECOGNIZED COMPLICATIONS SECONDARY TO PERITONSILLAR AND LATERAL PHARYNGEAL ABSCESS

WITH CASE REPORTS

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The title of this paper might imply that I have discovered something new in otolaryngology, but I have no such conceit. There are, however, some obscure and exceedingly dangerous complications attendant on the most usual and apparently innocent infections with which laryngologists have to deal. These are all too frequently discovered only when the patient is on the autopsy table. These are infections of the great vessels of the neck secondary to infection in and about the tonsils and the retropharyngeal spaces and spreading by way of the pharyngomaxillary fossa.

I shall not review the anatomy, as this has been done in almost every article written on this subject. I was asked to present a paper at the meeting of the American Laryngological, Rhinological and Otological Society just after I had observed two cases of infection of the jugular vein and one of spontaneous (?) hemorrhage following infection of the throat. It seemed to me worth while, in view of the differences of opinion voiced by various members of the staff of the Massachusetts Eye and Ear Infirmary, to report these cases in conjunction with some ideas I have on the subject. Knowing where I received my training and with whom it has been my good fortune to be associated for the past twenty years or more, the reader need not be told the basis of these ideas.

Isolated reports of septicemia from infection of the jugular vein began to be found in the literature about 1916. In 1917 Goodman [1] reported a case of excision of the jugular vein following follicular tonsil-

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1. Goodman, Charles: Primary Jugular Thrombosis Due to Tonsil Infection, Ann. Otol., Rhin. & Laryng. **26**:527 (June) 1917.

litis with recovery. The sigmoid sinus was not opened in this case. Mosher [2] in 1920 reported a fatal case following a retropharyngeal abscess. He opened the neck, but the vein could not be recognized. Autopsy was not allowed. In this paper he gave a clear comparison between his case and Goodman's and leaned toward the idea of also opening and packing the sigmoid sinus to prevent secondary hemorrhage. He also gave a full account of the anatomy of the various structures and fascial layers of the neck, along with a description of the pharyngomaxillary fossa. This is the most important area of the neck, and he has been successful in keeping it to the fore. Fifty-eight cases collected up to 1927, with thirteen recoveries, were reported in 1929 by Nussbaum.[3] Since that time the percentage of recoveries has increased somewhat, but it is still alarmingly low. Dr. James W. Babcock [4] in 1934 reported three cases; one patient had acute tonsillitis, another a pimple on the chin which was squeezed and a third mastoiditis with perforation, which was possibly secondary to ascending infection of the sigmoid sinus, with abscess of the brain followed by death. In all three the blood culture was positive; in one it showed streptococci, and in two staphylococci, all of which were hemolytic. F. P. McNamara [5] in 1935 reported four cases with descriptions of the observations at autopsy, in none of which was the condition correctly diagnosed except at autopsy.

The following two cases, in one of which recovery occurred after operation, typify the seriousness of these complications and the necessity for prompt and thorough surgical treatment.

Case 1.—Z. A., a woman aged 24, was admitted to the Massachusetts Eye and Ear Infirmary on April 25, 1936, complaining of sore throat and headache on the right side of three weeks' duration. She had been hospitalized during this period. Four days after the onset she had difficulty in swallowing and breathing. The right side of the throat was incised. Some pus was obtained, which gave relief. On the following day the abscess was reopened, and twice within twenty-four hours it ruptured spontaneously. Swelling behind the angle of the jaw on the right side, with soreness, had been present since the onset, and later swelling developed in the right postaural and occipital regions. No difficulty in swallowing or breathing was experienced after the abscess was drained. The temperature continued to swing between normal and 104 F., a condition which had persisted since before the abscess was opened.

A roentgenogram of the mastoids on April 27 was reported as showing no abnormality, but it was felt that there might be some involvement on the right

2. Mosher, H. P.: Deep Cervical Abscess and Thrombosis of the Internal Jugular Vein, Laryngoscope **30**:365 (June) 1920.

3. Nussbaum, David: Pyemia Following the Anginas, Laryngoscope **39**:787 (Dec.) 1929.

4. Babcock, J. W.: Cases of Jugular Thrombophlebitis Following Infections of the Face and Throat, Laryngoscope **44**:360 (May) 1934.

5. McNamara, F. P.: Jugular Thrombosis Following Tonsillar Infection, J. Iowa M. Soc. **25**:262 (May) 1935.

side, either primary or secondary to ascending infection of the jugular vein. A lumbar puncture was done two days later, and 2 cc. of clear spinal fluid was removed. The Tobey-Ayer test showed blocking of the right jugular vein. A culture of blood showed hemolytic streptococci after fifty hours.

Five days after the patient's admission to the infirmary exploration of the neck, ligation of the right internal jugular vein and simple mastoidectomy on the right side were performed. An incision was made over the anterior border of the sternocleidomastoid muscle, and the sheath of the great vessels was exposed. The right internal jugular vein was thrombosed. It was tied with no. 2 chromic catgut, and about 2 inches (5 cm.) was resected. The swelling in the posterior occipital region was explored, and no pus was found. No evidence of infection was found in the neck. The incision in the neck was continued superiorly behind the ear, exposing the mastoid. The bone bled freely. The mastoid contained thin yellowish fluid. Toward the tip, one of the deeper cells contained a small amount of pus. The sinus plate appeared normal. The sinus was exposed, and the wall was yellowish gray to the upper knee. The sinus was opened, and a portion of the wall was removed. Thick yellow pus welled up through the incision and was removed by suction. There was free bleeding from the direction of the torcular but no bleeding from below.

On May 1 the culture of material from the mastoid cells and of pus from the sinus showed hemolytic streptococci. On May 2 there was swelling along the wound in the neck, with discharge of pus at several points. All sutures were removed, with resultant drainage of about 15 cc. of creamy yellow-gray pus. On May 7 the patient was given a transfusion of 500 cc. of citrated blood. By June 1 the mastoid cavity was filling in well and the wound in the neck was healing, and on June 13 the patient was discharged to the outpatient department as improved.

Case 2.—M. T. D., a white woman aged 27, was admitted to the otolaryngologic service of a nearby hospital on Aug. 28, 1936, with a peritonsillar abscess. She complained of sore throat for one week prior to admission, with swelling in the left side of the neck and difficulty in swallowing. The abscess ruptured on the following day. Her past history was irrelevant. Medical consultation revealed no evidence of pneumonia or pulmonary complications, but on August 31 the clinical findings were consistent with pleurisy with effusion, and on September 1 the clinical findings were suggestive of episodes of pulmonary infarction. She was transferred to the medical service at that time. Five days later examination in consultation with members of the otolaryngologic service revealed findings suggestive of jugular phlebitis secondary to peritonsillar abscess, and it was advised that the jugular vein be tied when the patient's temperature dropped. In a consultation with members of the otolaryngologic service on the following day, the condition was found to be worse than could be accounted for by the pathologic condition of the throat, and it was considered advisable to examine the chest. There was a third consultation with members of the same service on the next day. The temperature having dropped 2 F., jugular phlebitis was considered less of a possibility. Ligation of the jugular vein was not advised at that time. Ligation of the left internal jugular vein with the area under local anesthesia was performed on September 11, twenty-one days after the onset of the disease. The patient continued to have a septic temperature with chills, and when I saw her for the first time, on September 16, I advised roentgen examination of the mastoids and opening of the left mastoid, with exposure of the lateral sinus. At that time the wound in the neck was healing well from the ligation of the jugular

vein performed on September 11. She was again transferred to the otolaryngologic service. Roentgenograms taken on September 17 showed cellular fusion in the left mastoid and a rather large and superficial sinus. The right mastoid showed thickening of the walls of the cells, suggesting some previous infection. On September 20 a simple mastoidectomy on the left side under local anesthesia was done, with exposure and incision of the left lateral sinus. The cells were clear, and the wall of the sinus appeared normal. The sinus was incised after a specimen of blood was taken for culture. At first only blood was obtained. A curet was inserted into the sinus toward the bulb, which produced creamy pus. The sinus was packed off. On September 28, eight days after the mastoidectomy, the patient died. The observations at autopsy were as follows: pulmonary embolism, multiple pulmonary abscesses, empyema, pleuritis, thrombosis of the left lateral sinus, localized meningitis and cerebellar abscess.

My conclusions regarding this case are that there was unnecessary delay in the procedures which were urgently indicated—exploration of the neck, ligation of the jugular vein and exposure and opening of the sigmoid sinus. Had these been done, it is possible that this patient might now be living.

A third case differed from these two in that the arterial, not the venous, system was involved:

Case 3.—S. B., a white girl aged 17, was admitted to the Massachusetts Eye and Ear Infirmary on May 7, 1936, complaining of a sore neck, with pain radiating to the left ear. She had had a tonsillectomy at the age of 11 years. Her present illness began two and one-half months previously, when she went to bed with headache, a sore, stiff neck on the left side, sore throat and slight swelling in the left side of the neck. She was treated for a week by her local physician with spray, pills and poultices and later with ice. In that week she had three severe hemorrhages from the throat. At the end of the week she was sent to the Lowell General Hospital, where she was treated with liver extract and ice packs and was discharged seven days later. During this stay at the hospital there were no hemorrhages. Three weeks later, while she was under her physician's care at home, her throat was lanced and a small amount of pus was obtained, with much bleeding. After this she seemed improved, the pain and swelling subsiding. Two weeks later, the seventh week after the onset of the illness, she had a severe hemorrhage from the throat followed by general malaise and weakness, with recurrence of swelling and pain and severe temporal headache on the left side. She returned to the Lowell General Hospital after two more weeks, approximately one week before she entered the Massachusetts Eye and Ear Infirmary. Five days previous to her admission to the infirmary, while she was in the Lowell General Hospital, a specimen for biopsy was taken from the gland in the left side of the neck, and the next day an incision into the left pharyngeal wall was made. No blood, pus or fluid of any nature was obtained. She had one more hemorrhage two days before being transferred to the infirmary. Her symptoms on May 7 were sharp, stabbing pain in the left side of the neck radiating to the left ear, general throbbing headache radiating down to the back of the neck and general weakness. A diagnosis of tumor of the nasopharynx was made. At 9:30 p. m. she was given a transfusion of 500 cc. of blood. The next day at 1:30 a. m. she had a hemorrhage from the mouth and vomited 10 ounces (300 cc.) of bright red blood. There was also slight bleeding from the

wound in the neck. She was given a clysis of 1,000 cc., and the bleeding stopped spontaneously. On May 8, the same day, I did a ligation of the left common carotid artery, using ether anesthesia. Two no. 2 chromic sutures were placed around the jugular vein and brought out at the inferior extremity of the wound, to be tied later if advisable. The old incision was explored with the finger. A thin discharge with a foul odor exuded from the wound. It was packed with iodoform tape. The patient was given a transfusion with 500 cc. of citrated blood. The ligatures around the jugular vein were removed on the second day. After the operation pus drained from the wound for about three weeks. She recovered with no further complications other than pain in the left ear and the tip of the mastoid and atrophy of the left side of the tongue. The membrana tympani was normal. On June 12 she was discharged to the outpatient department as improved.

CONCLUSIONS

1. In too many cases of peritonsillar or lateral pharyngeal abscess complications are unrecognized or inadequately operated on.

2. The pharyngomaxillary fossa is most important. It lies in a key position and is to the deep infection of the neck leading to infection of the blood stream as the ethmoid bone is to sinusitis and orbital infection.

3. Cultures of blood are not to be depended on, as the results are negative in a majority of the cases reported. Cultures should be grown both aerobically and anaerobically in all cases, and doubtless a much higher percentage of positive cultures would be found.

4. In all cases in which there is definite thickening of the vein or a thrombus obliterating the vein up to the jugular bulb, the mastoid should be opened and the sigmoid sinus explored. I am convinced that a great many of the secondary complications, such as septic emboli, are liberated through the petrosal veins and the torcular to the general circulation from an infected sinus above the jugular bulb.

ESOPHAGEAL SPEECH FOR ANY LARYNGECTOMIZED PATIENT

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A summary of the medical experience in teaching esophageal speech, with a detailed survey of the literature, was published by Dr. W. W. Morrison [1] in 1931. He and his associates have continued the work.

In the phonetic laboratories an occasional case of esophageal voice has been studied.[2] In the Oberlin Psychological Laboratory my associates and I have developed methods and apparatus for recording and analyzing the movements of normal speech, including the changes of air pressure in the mouth and the concomitant pulses of the abdominal and thoracic muscles.[3] We have applied these methods of recording and analysis to the movements of esophageal speech. When the details of the process are understood, it is possible to develop a positive and certain process of training.

Can all patients be taught to speak?

The answer is: If the patient can swallow satisfactorily, he can learn esophageal speech.

The type of voice and its quality may depend on the throat of the particular patient; it may not be possible to develop a good tone, but speech is possible which is audible in an ordinary room and which can be used at the telephone. Hugo Stern's group of one hundred cases is excellent evidence; only two of the patients failed to speak. His methods can be improved, but he had the requisite persistence and enthusiasm.

The type of voice and the sort of speech depend on the early training. Some patients stumble into excellent methods. However, the process of learning need not be left to chance; it can be directed.

It is important to avoid the unsatisfactory buccal whisper, because it is produced with high air pressure in the mouth with the esophagus

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Read at the Fifty-Ninth Annual Congress of the American Laryngological Association, Atlantic City, N. J., May 31, 1937.

1. Morrison, W. Wallace: The Production of Voice and Speech Following Total Laryngectomy, Arch. Otolaryng. **14**:413-431 (Oct.) 1931.

2. A case of H. Burger was investigated in the laboratory of L. Kaiser, Acta oto-laryng. **8**:90, 1925-1926.

3. Stetson, R. H.: Speech Movements in Action, Tr. Am. Laryng. A. **55**:29, 1933.

closed against this high pressure. In producing the buccal whisper the patient is training himself to close the esophagus and to keep it closed tight, which is exactly opposed to the process of esophageal speech.

As soon as the patient is able to swallow, the training in speech should begin. Some one whom the patient can imitate is a great help. Another laryngectomized speaker can do a great deal in starting the process, and if he is aware of the details of the process can make an excellent teacher. However, it is not difficult for any nurse or orderly to learn to say a few syllables with the glottis closed, using the esophagus. Esophageal speech should be the patient's one form of speech until it is mastered. A writing pad may be a supplementary means of communication.

It is not enough to start the patient to saying a few syllables with the example of another esophageal speaker and then leave him to his own unaided efforts to recover speech. Reeducation for the patient must be a slow process and needs guidance; learning esophageal speech is as difficult as learning to sing or as learning to pronounce a foreign language. Left to their own efforts many patients will achieve fair speech but others will not stumble onto the right coordinations. Competent teaching will make satisfactory speech possible to nearly all laryngectomized persons and will shorten the process for those who would in the end attain speech for themselves.

The artificial larynx is easily mastered and does not interfere with esophageal speech, but it is a distraction and a temptation both to the patient and to the responsible surgeon. An artificial larynx should not be considered until at least six months after the patient is able to be up and about. It is the last resort for the rare patient who is unable to learn esophageal speech and perhaps an occasional convenience to some esophageal speakers who find it difficult to fill a large room or to manage esophageal speech at the telephone.

I need not consider the type of speech in which a large amount of air is gulped into the stomach. It is disagreeable and unsatisfactory.

In the available form of esophageal speech the air used for speech does not enter the stomach; the small reservoir of air is in the upper part of the esophagus. A study of such speech with adequate phonetic apparatus shows these characteristics:

1. The chest action for each syllable and the breathing movements for phrasing are those of normal speech.

2. Only a little air is taken into the upper part of the esophagus: from 2 to 5 cc.

3. This intake is made frequently and rapidly with the mouth and the velum closed; it often fuses with the movement of the consonant. Intake

of air every few syllables is the one thing contrary to ordinary speech which the patient has to learn. Using the constriction of the esophagus as a pseudoglottis is a novel experience, but it does not clash with previous habits as does this intake process.

The pseudoglottis is formed at the constriction of the pharynx and the esophagus. It must open easily for the frequent intake of air, and it must contract for the pulses of the syllable.

It is not advisable to give the patient charged beverages or compound effervescent powders U. S. P. to produce a supply of gas in the stomach. It is likely to give him a false impression of the amount of air necessary and to make him feel—as did some of the earlier investigators—that

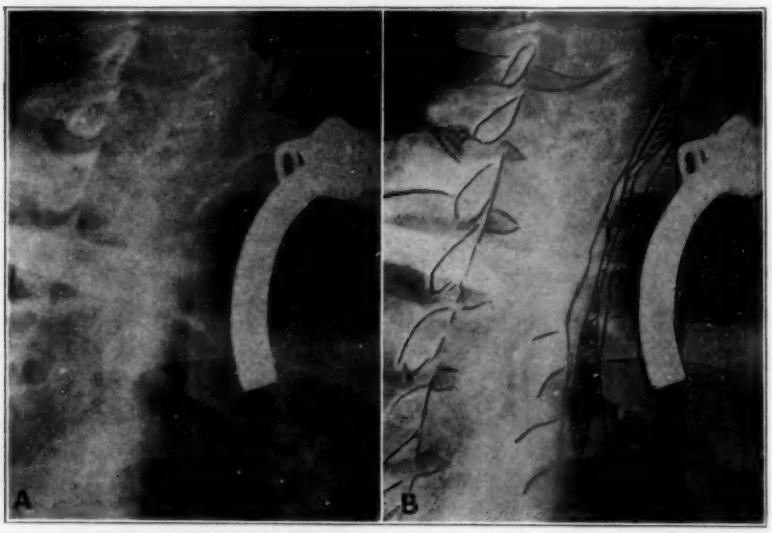

Fig. 1.—*A*, a roentgenogram showing the mass of air in the esophagus during esophageal speech. *B* shows the same view with the outlines retouched on cellophane laid over the plate.

The constriction between the pharynx and the esophagus shows clearly.

The plate shows the lowest extension of the mass of air in the esophagus—to the level of the fifth thoracic vertebra.

The apparent enlargement of the lower part of the mass of air is probably due to the bending of the esophagus because of the patient's position.

The mass of air is fusiform, and through the fluoroscope can be seen to be responsive to the changes of pressure in the trachea; it is possible for a patient to oscillate the air back and forth through the pseudoglottis in a rapid panting movement.

the voice is somehow dependent on air in the stomach. The supply of air must be from above, not from below, and the first thing to learn is the insufflation.)

The normal person has no difficulty in closing the glottis and drawing from 2 to 5 cc. of air into the esophagus at a single effort. This is a sufficient supply.

At first the laryngectomized patient may find it convenient to close the tracheal cannula to insufflate air into the esophagus, but in a short time he will be able to produce the slight negative pressure with the trachea open. The normal person draws air into the esophagus with the mouth open; but the patient must learn to close the mouth and use

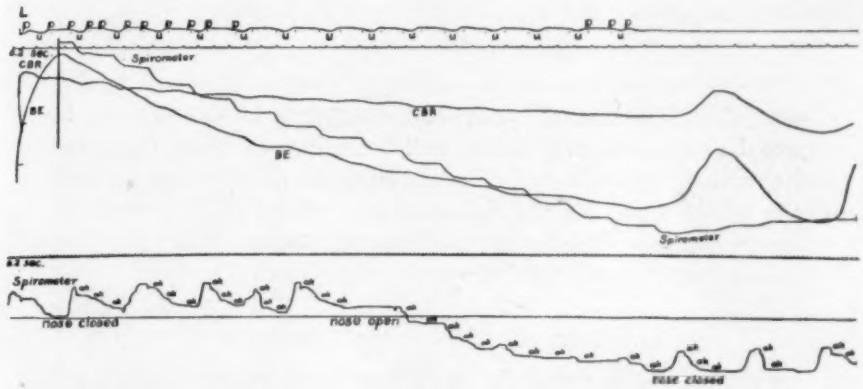

Fig. 2.—Comparison of spirometer records of normal utterance and the utterance of a subject with excellent esophageal speech. The record above is to be used for comparison with the record below and with the line marked *spirometer* in the upper record of figure 3.

In the upper record *L* indicates the movements of the lips, showing the consonants of a series of "pup, pup . ." with doubles. The line marked *spirometer* indicates the reading of a light, delicate spirometer recording the volume of expired air; note the steady descent for each syllable uttered and the amount of air in the lungs of the normal subject. *CBR* indicates the movement of the rib-cage as recorded from the boss. The position of the rib-cage changes little, except at the inspiration at the close of the series of syllables. *BE* indicates the movement of the epigastrium, as recorded from the boss. The movement of the upper abdominal muscles parallels that of the spirometer record of the expired air.

In the lower record the line marked *spirometer* indicates the record of the largest amount of air the subject can "expire" from the mouth in speech. Only three or four syllables can be given without intake, and the amount of air expelled in any series is only a few cubic centimeters. There are readjustments with the nose open and closed, but there is never any indication of more than 3 or 4 cc. of air in the esophagus. Compare this with the upper record of figure 3, in which the air is renewed for each syllable, and there is no more than 1 cc. of air for each syllable.

By calibration, a drop of 10 mm. equals 2.4 cc. of expired air. As the total volume enclosed in the system is small, readjustments of the position of the mouth, as in *nose open* and *nose closed,* make a large variation and must be checked out.

the compression movement of swallowing to force air into the esophagus quickly. Early practice may consist of taking air into the esophagus, expelling it and again taking in air.

The fundamental differences between the normal person's breath taking and the intake of air by the laryngectomized person lie in the following facts:

The laryngectomized patient takes air with the mouth and the velum closed.

The laryngectomized patient takes air much more frequently than does the normal speaker.

CHEST ACTION

The chest action involved in esophageal speech consists of the normal movements of breathing somewhat exaggerated. Instead of being expected to suspend chest action and breathing, as Stern suggests, the patient actually depends on the normal pulses of the chest for the making of the syllables and for the movements of phrasing. The chest action is the mechanism whereby he produces the variations of air pressure in the esophagus necessary for speech (figs. 3 and 4).

CHEST PULSE FOR THE SYLLABLE

In normal speech the air in the trachea is not under continuous pressure; a sudden rise of pressure produces each syllable. In esophageal speech there must be similar pulses forcing the air through the pseudoglottis to produce the syllables. The pulses in the esophagus are produced by the original coordinations; pulses of air in the trachea are communicated through the common wall to the esophagus; thus, the original chest pulses of normal speech persist to produce the syllables of esophageal speech. In figure 6 the subject was saying "pup, pup, pup, . . .," and the rises of pressure in the trachea of the laryngectomized subject can be seen clearly in the *sub-glot.* tracing. The two tracheal pulses of "ap-pa" show in the *sub-glot.* tracing in figure 5, and they also appear in the *sub-glot.* tracings of figures 7 and 8.

RAPID AND FREQUENT RENEWAL OF THE AIR SUPPLY

The new process of taking in air for speech involves the closure of the mouth and the velum, as opposed to the open position of the mouth in normal speech. This is often confusing, and as the patient tries for fluency is often the cause of setbacks and discouragement.

At first the intake of air is a distinct action, as shown in figure 5, in which the rise of air pressure in the mouth marked *intake* shows that the mouth is closed while air is forced into the esophagus, and after a perceptible pause (0.1 to 0.2 seconds) a syllable or two is pro-

nounced. For these first syllables, vowels or vowels with liquids and semivowels prove easiest: "Oh yeah, Oh no, Oh la la," etc. The important thing is to practice the intake until it is easy and certain, though it takes considerable time and only the two or three isolated syllables can be said.

As soon as the intake by compression of the mouth and expansion of the chest is fairly easy, it is important to develop tone. The esopha-

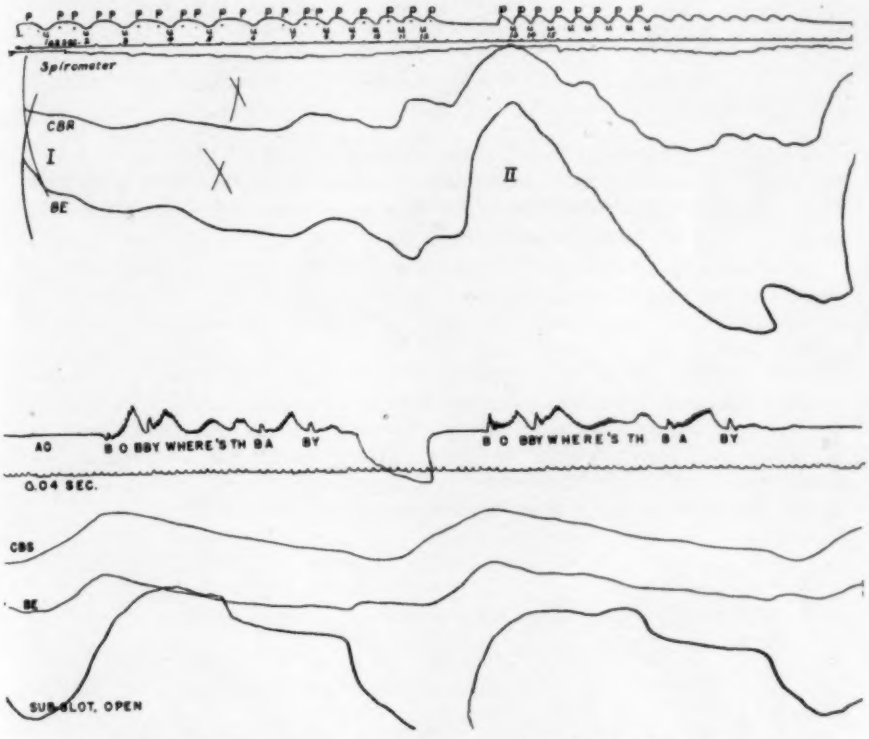

Fig. 3.—Esophageal speech of two laryngectomized subjects showing the exaggerated movements of the chest. The record above gives a series of "pup, pup,..." said slowly enough to double, followed by a rapid series. The record below shows the phrase "Bobby where's the baby" with vigorous movements of the chest.

L indicates the movement of the lips, with a record of "p"s of "pup.." *AO* indicates the air just outside the mouth, with a record of the vowels and consonants. *Spirometer:* Compare with the upper record of figure 2. This shows slight expiration of air from the mouth, which is renewed for each syllable. *CBR* indicates the movement of the rib-cage as recorded from the boss. More vigorous movement is noted than in the normal subject. *CBS* indicates the movement of the sternum as recorded from the boss. More vigorous movement is present than in a normal subject. *BE* indicates the movement of the epigastrium as recorded from the boss. More vigorous movement is present than in a normal subject. *Sub-glot.* indicates the record of air flow in the trachea, which is extreme as compared with that in a normal subject.

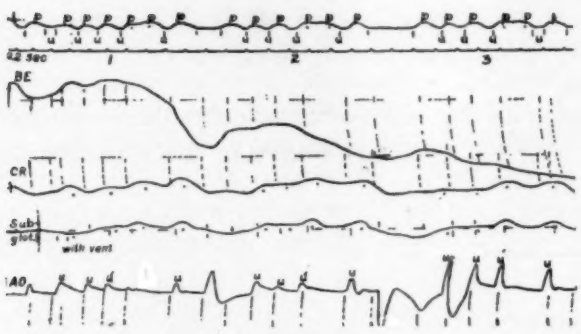

Fig. 4.—Esophageal speech of a laryngectomized subject, showing the normal movements of the chest and the articulatory organs in speech. There is frequent intake of air without disturbance of the flow of utterance. This is a record of groups of syllables, "pup, pup, pup,' pup."

L indicates lip movement. The arresting "p"s are dropped in rapid syllables, but the consonants following the accent are invariably double. *BE* indicates the movements of the epigastrium and shows well defined phrasing movements for each syllable group, and there is a slow progressive descent during the entire series of syllable groups. *CR* indicates the chest pulse as indicated by a negative pressure applicator. Marked pulses are indicated for each syllable of the group. *Sub-glot.* indicates the pulses in the trachea taken with a vent, so that there is no progressive descent during the group. *AO* indicates the air pressure just outside the mouth. This line shows an intake of air at least for every syllable group. Often the intake is more frequent than once in four syllables.

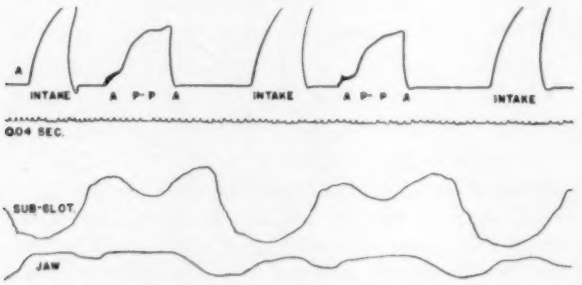

Fig. 5.—Intake movements between words in esophageal speech of a laryngectomized subject, for the syllables "ap-pa."

A indicates the air pressure in the mouth. The rapid rise for the "intake" shows that a swift compressing movement of mouth is forcing air into the esophagus. The doubling of the "p" in "ap-pa" is apparent in the curves; the lips are closed between the syllables. *Sub-glot.* indicates air pressure in the trachea. The pressure is lowest during the intake movement. There are pronounced pulses for the syllables. *Jaw* indicates the movement of the jaw, which is marked for the word and also for the intake movement; the jaw cooperates in the compressing movement for forcing air into the esophagus.

geal constriction must be got under control. A normal person will find that pressure with the fingers against the larynx will help him to adjust the mouth of the esophagus so that he can get tone on a syllable or two uttered with the esophageal air. In the same fashion the laryngectomized patient may press with the fingers on either side of the tracheal cannula and adjust the esophageal opening so that a tone results. Having got the feel of the proper tension for tone, it is not difficult to get the muscular adjustment in the throat, and the patient soon finds that it is not necessary to use outside pressure.

At this stage the patient is able to say a word or two, but his speech is artificial and extremely limited. He readily learns to give the voiced consonants as well as the unvoiced and to make syllables beginning with consonants and closing with consonants. Different vowels come more easily for different subjects, and practice should begin of course with the easy vowels. In the following phrases the comma above the line is used (as in singing) to indicate the intake.

, , , , , , ,
"Pay day pay day pay day today It is pay day today.

, , , , , , , , ,
Pea tea may be P. T. for pea tea Pekoe tea may be P. T."

Then closed syllables, like

, , , ,
"Cellar door seal it up seal it up

, , , ,
Yes yes puppy up up puppy."

Thus, the patient comes to have command of the various vowels and can make the consonants, both releasing and arresting, in a simple series of two or at most three syllables. His speech is slow; the phrase is limited to these few syllables; the intake process is a labored interruption, and the next step is to get fluency.

Left to himself the patient is likely to try to increase the amount of air taken in. He wishes to lengthen the phrase and to be able to say simple sentences freely. But the attempt often proves mistaken. The increased air pressure in the esophagus interferes with the action of the pseudoglottis; he loses air unexpectedly and is unable to get out the last syllable or two. In rather spasmodic efforts he often swallows considerable air and suffers discomfort, or involuntary belching confuses his utterance.

The subject must be taught to confine his breath group to a few syllables, five or six at most; often two or three are better. But the

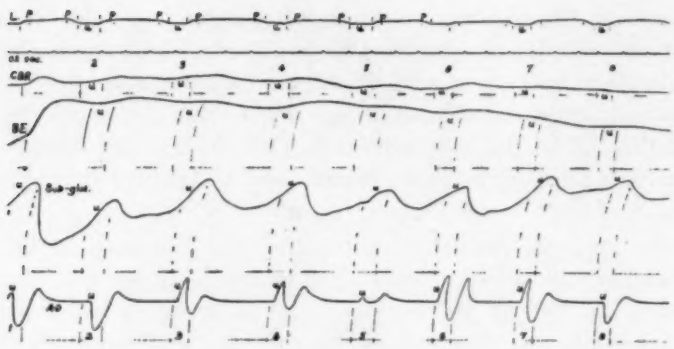

Fig. 6.—Esophageal speech of a laryngectomized subject, showing the rapid expulsion and intake of air for each syllable, of "pup, pup," said slowly, with the consonants doubling.

L indicates lip movement in obvious doubles; the lips are closed between syllables. *CBR* indicates movement of the rib-cage. There is slight movement for each syllable but no recession. *BE* indicates the movement of the epigastrium. Slight movement is made for each syllable—perhaps slight recession during the whole series. *Sub-glot.* indicates the air pressure in the trachea not connected with the mouth. Pronounced pulses are present for each syllable. *AO* indicates air pressure just outside the mouth. A sudden rise of pressure indicates the rapid expulsion of air from the esophagus, followed by an equally rapid fall in pressure, indicating the intake of air for each syllable.

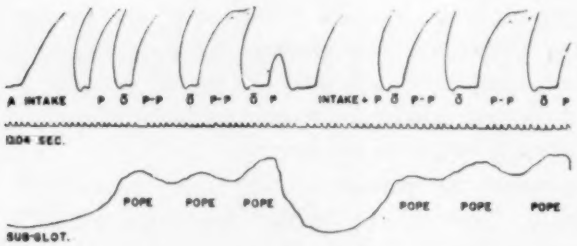

Fig. 7.—Fusion of the "intake" movement with the initial consonant of a group of syllables ("Pope pope pope") in the esophageal speech of a laryngectomized subject who had not completely mastered the method of taking in air.

A indicates air pressure in the mouth. The first "intake" movement in the record is a separate movement. The intake movements often show "doubling." *Sub-glot.* indicates the air pressure in the trachea. Pronounced chest pulses are indicated for each syllable of the group; the accents are well marked.

intake must be made so as not to interfere with the chain of syllables.) If the subject will repeat phrases like

"Pay day today . . . pay day today . . . pay day today pay day today . . ." faster and faster, he will find himself taking in air on the consonant closure of the "t"; the breathing will have become "pay day today pay day today;" "up up puppy, up up puppy up up puppy" will have become "up up puppy up up puppy;" the lips will not part for the p-p of "up-puppy," but enough air will be forced from the mouth into the esophagus for the syllables "puppy."

The frequent intakes on consonants of a skilled esophageal speaker are shown in figure 6, "pup pup pup . . .," in which the lip tracing

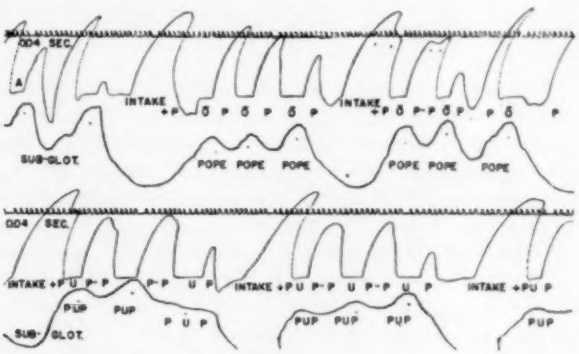

Fig. 8.—Fusion of the intake movement with the releasing consonant of a series of syllables—"pope, pope, pope,' pope, pope, pope'" and "pup, pup, pup', pup, pup pup'."

A indicates air pressure in the mouth. The intake movements occasionally show a doubling form, indicating the partial fusion, but the first group in the upper line and the middle group in the lower line show the simple form of complete fusion. *Sub-glot.* indicates the air pressure in the trachea. Pronounced chest pulses are present for each syllable of the group; the accents are well marked.

shows that the lips are closed between the syllables and an intake occurs on the final consonant of each syllable. An intake occurs in the syllable chain of group 3 in figure 4.

It is now possible to show the patient where he makes his intakes, sometimes between breath groups when the phrasing permits and sometimes on some convenient consonant in the series of syllables. Exercises

can be typed for him in which the intakes are indicated, so that he may practice selected material:

"Speak the speech I pray you as I pronounce it to you trippingly on the tongue."

"Surely the tongue is an unruly member."

The subject should learn to speak right on, in comparatively short sentences, but long enough to demand rapid and frequent intakes and often on consonants; each rather short sentence should be spoken at a good normal rate.

Intonations and rise or fall of the voice at the close of a question or of a declaratory sentence will develop in the course of a year or so. The patient achieves natural and fluent speech.

Oberlin Psychological Laboratory.

FALSE RESPONSE TO THE JUGULAR COMPRESSION (TOBEY–AYER) TEST DUE TO ANOMALY OF THE LATERAL SINUS

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The case of thrombosis of the lateral sinus reported here was rather remarkable in that the response to jugular compression, which was strongly positive, indicated that the trouble was on the opposite side from that on which it was actually found. This false indication was due to an anomaly of the venous sinuses.

Incidentally, the case was investigated by a court as an instance of death due to an industrial accident. The plaintiff recovered damages.

The chief points of interest follow:

F. R., a man aged 55, a laborer in a factory, was struck at the root of the nose by a piece of falling press-board on April 24, 1936, and sustained a superficial cutaneous wound. It was treated with mercurochrome and a dressing. He had acute rhinitis at the time, which was apparent during the days which followed.

Six days later, on the morning of May 1, severe epistaxis from the left nostril developed, and he was removed to a hospital. A consulting rhinologist found it necessary to pack the left nasal space to control the bleeding. The pack was replaced on May 2 and on May 3. On May 5 it was removed and not replaced.

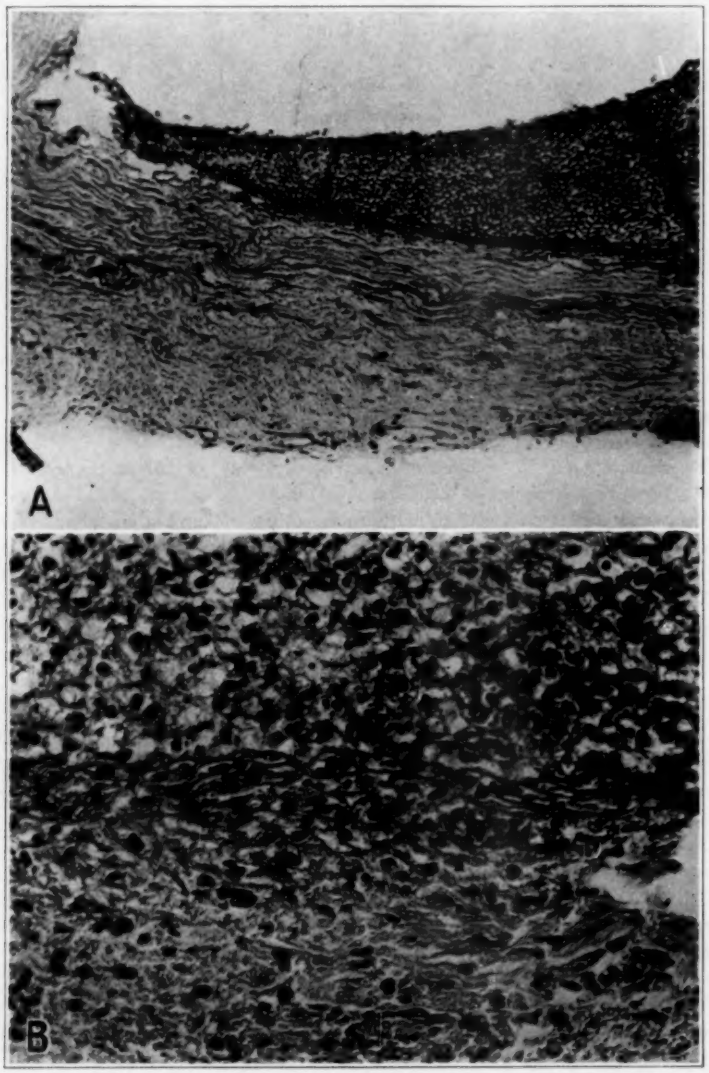
On May 3 a fever began to appear, which took a septic course and continued until death (May 9). It was also noted on that day that hearing was markedly reduced in both ears. On May 4 the left ear was found to be discharging. This also continued until death. Pneumonia was diagnosed on May 6, and there was marked abdominal distention. Blood counts at that time indicated marked anemia (42 per cent hemoglobin) and moderate leukocytosis (12,400).

I first saw the patient in consultation on May 7. At that time he obviously had pneumonia and was in a profoundly septic state. The positive findings noted were: marked anemia of the fundi, bulging of the drum of the right ear, which was very red in Shrapnell's area, and filling of the canal of the left ear with pus, the drum being red and swollen. No swelling was noted over either mastoid; tenderness was indeterminate.

In the anterior region of the nose large crusts were present on both sides, covering the turbinates and the septum. The mucous membrane was swollen and inflamed. In the posterior region an inflamed area was present on the rostrum of the left sphenoid sinus, with a thin streak of pus extending posteriorly. Transillumination showed that both maxillary sinuses were cloudy.

A spinal puncture was done, and the spinal pressure was found to be 16 mm. of mercury. The response to the jugular compression test was definite. Compression over the right internal jugular vein raised the pressure of the spinal fluid to 31 mm., whereas compression over the left raised it only to 18 mm. This indicated definitely a closure of the left lateral sinus.

Everything seemed to indicate septicemia due to sinus thrombosis on the left, complicating otitis media and mastoiditis on the same side. The left side of the nose had been packed while the patient had an acute cold, after which there had developed deafness, with suppurative otitis media on the left and a septic tem-



A, mural thrombus found in the right jugular bulb at the point contiguous with the hypotympanum. *B*, high power view of the mural thrombus illustrated in *A*, showing its attachment to the wall of the vessel.

perature, with chills and fever, and on examination a positive response to the jugular compression test was elicited, indicating closure of the left lateral sinus.

Operation on the left mastoid and the left lateral sinus was considered, but because of the near moribund condition of the patient this was not undertaken. Paracentesis was done on the right.

Death came on May 9.

Necropsy.—The principal change noted was bilateral suppurative otitis media with early bilateral mastoiditis. There was no thrombus in the left lateral sinus. Instead, it was found that the sinus was structurally small. At one point near the torcular it measured only 7 mm. in circumference and the lumen was in the shape of a slit. On the other hand, the right lateral sinus was very large. Obviously, practically all the venous return from the cranial cavity passed through the right lateral sinus. Near the torcular, in a position corresponding to the narrow point on the other side, it measured 33 mm. in circumference. The sigmoid sinus and the bulb were very large, especially the bulb. The latter came in intimate contact with the hypotympanum, there being only a paper-thin layer of bone between. At this point there was a mural thrombus (fig.), which was doubtless the source of the septicemia. Both sphenoid sinuses, several of the ethmoid sinuses and the left maxillary antrum contained fluid pus. The turbinates were covered with exudate and necrotic tissue. An abscess was found in the muscles overlying the thyroid gland and another in the right pectoral muscle. Both lungs were extensively involved with bronchopneumonia.

In this case a septic process developed after the packing of the nose to control hemorrhage in the presence of acute rhinitis. Otitis media followed on both sides but seemed more advanced and more severe on the left. Septicemia developed and finally caused the patient's death. The reaction to the Tobey-Ayer test indicated that the left lateral sinus was closed and the right one open. This proved at necropsy to be correct, but the closure on the left was due to a developmental anomaly and not to thrombosis. The right sinus was extremely large and wide open but contained a septic mural thrombus, the source of the infection. Had I operated, it would have been on the left and my efforts would have been fruitless. Had the thrombus on the right actually been discovered and that sinus been closed by operation, the patient must surely have died promptly from cerebral congestion.

DISTURBANCES OF TASTE OF OTITIC ORIGIN WITH SPECIAL REFERENCE TO OPERATIONS ON THE EAR

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The perception of taste in the anterior two thirds of the tongue occurs through the chorda tympani nerve, whereas the posterior third is innervated from the glossopharyngeal nerve.

Gustatory sense over the posterior third of the tongue has always been attributed to the glossopharyngeal nerve. The rôle of the chorda tympani in the transmission of the sensations of taste from the anterior two thirds of the tongue is also well established, but there is marked divergence of opinion in the medical literature as to the pathway for the taste fibers from the geniculate ganglion in the facial nerve to their central nucleus in the pons. It has been shown by many observers that the loss of taste on the anterior two thirds of the tongue has followed complete palsy of the fifth nerve, as in cases of extirpation of the gasserian ganglion. Cushing [1] in 1903, from his careful study and accurate, painstaking work in thirteen cases of extirpation of the gasserian ganglion, reached the following conclusions:

1. That the perception of taste is unaffected on the posterior portion of the tongue and never permanently or completely lost on its anterior two thirds after the removal of the Gasserian ganglion.

2. That a temporary abolition or lessening of the acuity of taste may be found to exist over the anterior and anesthetic portion of the tongue for some days after the operation.

3. That this temporary loss of function may possibly be occasioned by some interference with chorda transmission brought about by a mechanical or toxic disturbance due to degeneration of the N. lingualis.

4. That a lesion of the trigeminal nerve may be associated with disturbance of taste over the chorda territory without the necessary inference that the nerve is a path for gustatory impulses.

5. That the N. trigeminus in all probability does not convey taste fibers to the brain either from the anterior or posterior portion of the tongue.

From the Otolaryngologic Service of Dr. Gordon Berry, Memorial Hospital, Worcester, Mass.

Thesis submitted to the Faculty of Otolaryngology of the Graduate School of Medicine of the University of Pennsylvania in partial fulfilment of the requirements for the degree of Master of Medical Science.

1. Cushing, H.: The Taste Fibers and Their Independence of the Nerve Trigeminus: Deductions from Thirteen Cases of Gasserian Ganglion Extirpation, Bull. Johns Hopkins Hosp. **14**:71, 1903.

Harris and Newcomb,[2] accepting Nageotte's [3] anatomic demonstration that the fifth nerve and the sensory part of the seventh and of the ninth nerve have a common gustatory nucleus in the pons, expressed the belief that taste fibers have different courses in different persons but the fifth nerve is the principal nerve of taste.

Lewis and Dandy [4] in 1930 thoroughly reviewed the literature regarding the various pathways in the transmission of taste and came to the conclusion from their keen observations in operations on human beings that it is the nervus intermedius of Wrisberg, the sensory portion of the seventh nerve, which transmits the sensation of taste from the anterior two thirds of the tongue through the chorda tympani. The following are their observations:

1. Section of the sensory root of the fifth nerve is not followed by any permanent changes in taste, although in each instance all forms of sensation except taste over the trigeminal domain are totally absent.

2. After the intracranial division of the seventh nerve, including the sensory portion (nervus intermedius of Wrisburg, the N. glossopalatinus of Hardesty), taste to the anterior two thirds of the tongue is completely and permanently lost.

3. Division of the facial nerve, between the geniculate ganglion and the point at which the chorda tympani leaves the facial nerve to pass through the middle ear, is invariably followed by total and permanent loss of taste.

4. Intracranial division of the glossopharyngeal nerve is followed by complete and permanent loss of taste to the posterior one third of the tongue, but there is no effect on taste in the anterior two thirds of the tongue.

Reichert [5] in 1934 contributed additional proof that the pars intermedius of the seventh nerve conveys taste fibers to the ipsilateral anterior two thirds of the tongue from his observation of a patient with Ménière's disease following section of the auditory nerve and traumatization of the pars intermedius of the facial nerve. After the operation this patient had delayed perception of taste on the anterior two thirds of the tongue corresponding to the side operated on, but a test for taste three months later revealed that the affected side of the tongue responded to taste as quickly as the good side.

For a proper understanding of the disturbances of taste of otitic origin, it is necessary and important to have a clear conception of the

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2. Harris, W., and Newcomb, W. D.: A Case of Pontine Glioma, with Special Reference to the Paths of Gustatory Sensation, Proc. Roy. Soc. Med. **19**:1, 1926.

3. Nageotte, J.: The Pons Intermedia or Nervous Intermedius of Wrisburg, and the Bulbo-Pontine Gustatory Nucleus in Man, Rev. Neurol. & Psychiat. **4**: 473, 1906.

4. Lewis, D., and Dandy, W. E.: Course of the Nerve Fibers Transmitting Sensations of Taste, Arch. Surg. **21**:249 (Aug.) 1930.

5. Reichert, F. L.: The Surgical Treatment of Ménière's Disease, with Observations on the Function of the Pars Intermedia of the Seventh Nerve, S. Clin. North America **14**:1485 (Dec.) 1934.

anatomy and physiology of both the chorda tympani and the facial nerve. When the facial nerve is injured within the bony canal above the point where the chorda tympani leaves it, taste is lost over the anterior two thirds of the tongue.[6] Involvement of the chorda tympani in the tympanic membrane, as in otitis media, may lead to abnormalities of the sense of taste on one side of the anterior portion of the tongue.[7]

The facial nerve is a mixed nerve. Its major portion is motor in function. The sensory portion of the nerve is the nervus intermedius of Wrisburg, and the chorda tympani is considered to be a direct continuation of its fibers. Experiments with animals have demonstrated that the sensory portion of the seventh nerve and the chorda tympani contain not only taste fibers but salivary fibers to the salivary glands. Reichert and Poth [8] in 1933 submitted evidence of new pathways in the seventh and the ninth cranial nerve for the secretory fibers to the salivary glands in man. The aforementioned case of Ménière's disease reported by Reichert offers further proof that secretory fibers (except those accompanying the ninth nerve) to all three of the salivary glands course in the pars intermedius of the seventh nerve. Section of the chorda tympani in the tympanic membrane produces changes in the submaxillary and sublingual glands and causes marked permanent diminution of salivation [8] (Sewall and others). This change in the integrity of the submaxillary gland in lesions of the chorda tympani has been objectively demonstrated microscopically.[9]

ANATOMY

The facial nerve has its nucleus in the reticular formation of the lower part of the pons, and the fibers in the medulla form an eminence on the floor of the fourth ventricle. It leaves the brain stem between the olivary and the restiform body. It carries with it the nervus intermedius of Wrisburg, the sensory portion of the seventh nerve, which has its cells of origin within the geniculate ganglion. The facial nerve enters the internal auditory meatus with the auditory nerve. In the internal auditory meatus, it runs outward toward the roof of the middle ear, between the semicircular canals and the cochlea over the vestibule. Before it enters the middle ear, there is a grayish red swelling—the geniculate

6. Pollock, L. J., and Davis, L.: The Cranial Nerves, Am. J. Surg. **18**:396 and 554 (Dec.) 1932.

7. Deaver, J. B.: Surgical Anatomy, Philadelphia, P. Blakiston's Son & Co., 1903, p. 426.

8. Reichert, F. L., and Poth, E. J.: Recent Knowledge Regarding the Physiology of the Glossopharyngeal Nerve in Man with an Analysis of Its Sensory, Motor, Gustatory and Secretory Functions, Bull. Johns Hopkins Hosp. **53**:131 (Sept.) 1933.

9. Vlasto, M.: The Chorda Tympani Nerve in Otology, J. Laryng. & Otol. **45**:59 (Jan.) 1930.

ganglion. The ganglion gives several communicating branches: the great superficial petrosal nerve to the vidian nerve, which goes to the sphenopalatine ganglion, the small superficial petrosal nerve to the otic ganglion, which gives a branch to the tympanic plexus, and the external superficial petrosal nerve joining the sympathetic fibers which accompany the middle meningeal artery. The facial nerve then enters the middle ear, turns horizontally backward, lying between the external horizontal semicircular canal above and the oval window below, and then turns vertically down to make its exit from the stylomastoid foramen. In its course through the temporal bone the nerve is encased by the fallopian canal, and it frequently has dehiscences in its course, particularly in its horizontal portion. The points of escape of its branches as well as the pyramid are openings in the fallopian canal. (This may explain inflammatory paresis of the facial nerve.) In the middle ear, it gives a branch to the stapedius muscle. The chorda tympani is given off about ¼ inch (0.6 cm.) above the stylomastoid foramen. This nerve passes from below upward and forward within a distinct canal. It enters the tympanum through an opening in the posterior wall (iter chordae posterius) between the opening into the mastoid cells and the attachment of the tympanic membrane. The nerve passes through the tympanic cavity near the upper part of the membrana tympani, arches forward between the neck of the malleus and the incus and leaves the middle ear through an opening called the iter chordae anterius or the canal of Huguier, at the inner side of the petrotympanic fissure (glaserian). In the middle ear the nerve is covered by mucous membrane. After leaving the middle ear, it joins the lingual nerve of the mandibular branch of the fifth nerve on the deep surface of the external pterygoid muscle and accompanies it to the submaxillary gland. Part of the nerve joins the submaxillary ganglion, while the major portion continues through the muscular substance of the tongue to the mucous membrane which covers its anterior two thirds.

Disturbances of taste are of many varieties—ageusia, hypogeusia, hypergeusia and parageusia as well as hallucination—and the causes of such disturbances are numerous. It is not my intention to review the literature on this subject. Neither can it be within the scope of this paper to include and discuss every possible cause. My object in this paper is to discuss the subject from the point of view of the otologist, with illustrative cases. However, I shall mention briefly some of the more common causes of the disturbances of taste. Among the disturbances are (1) those due to local lesions of the tongue or the oral cavity, such as inflammation, scars and neoplasms, (2) those due to lesions of the nerves (seventh and ninth), intracranially or peripherally, such as injuries to the head (particularly fracture of the base of the skull), traumatic or surgical division of the nerve, rheumatic paralysis

of the facial nerve and acute or chronic suppuration of the middle ear, (3) those due to disease of the digestive system, and fever in which the patient complains of impairment of taste and loss of appetite, (4) those of a functional nature in neurotic or hysterical persons and lastly, but not the least, (5) hallucinations of taste in mentally deranged patients.

It is well recognized that the disturbances of taste are subject to influence by individual factors. That no two persons are alike in the reaction of their senses is well known. Persons differ in respect to the weakest concentration (threshold) at which they can detect a particular taste. Differences in threshold probably explain the whole matter. The sense of taste is often lost when the function of smell is interfered with. Many of those tested could not taste any sweet readily when the nose was closed. The reason for this is not yet clear, since the perception of sweet is supposed to have no connection with the nose. Whatever the explanation, it shows the difference between persons in their sensory reactions.[10] Pratt and Pratt [11] suggested that the gustatory function is enhanced by the odor of food and drink reaching the olfactory nerves and in this way combining the odor with the sense of taste.

Disturbances of otitic origin involving the sensation of taste on the anterior two thirds of the tongue depend on either of two factors—lesions involving the chorda tympani or lesions involving the facial nerve. The consideration of disturbances of taste is not new; rather is it a neglected subject. Even in reports in the literature concerning paralyses of the facial nerve mention of any change in the sense of taste on the ipsilateral anterior two thirds of the tongue is frequently forgotten. As to the involvement of the chorda tympani nerve, there appears little reference to it in the recent otolaryngologic literature. The reason for all this can be best explained by the fact that the patient does not notice any subjective change in his taste, and as a consequence tests for taste are not done.

Of the common conditions involving the facial nerve [12] whereby the sense of taste might be affected, the following are listed:

1. Neuritis of the facial nerve due to exposure to cold, toxemia, diabetes, syphilis and other specific and infective diseases.

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10. Blakeslee, A. F.: Some Differences Between People in Taste and Smell Reactions, Eugenical News **18**:63 (May-June) 1933.

11. Pratt, F. J., and Pratt, J. A.: Intranasal Surgery, Philadelphia, F. A. Davis Company, 1924.

12. Jackson, C., and Coates, G. M.: The Nose, Throat and Ear and Their Diseases, Philadelphia, W. B. Saunders Company, 1929. Turner, A.: Diseases of the Nose, Throat and Ear, ed. 4, Baltimore, William Wood & Company, 1936. Gleason, E. B.: A Manual of Diseases of the Nose, Throat, and Ear, ed. 7, Philadelphia, W. B. Saunders Company, 1933.

2. Facial paralysis from acute or chronic disease of the middle ear.[13]

3. Traumatic injury to the nerve, particularly in radical mastoidectomy.

4. Geniculitis.

Of the conditions affecting the chorda tympani nerve, the following should be mentioned:

1. Injury to the chorda tympani in suppuration of the middle ear.

2. Injury to the nerve following paracentesis of the tympanic membrane.

3. Injury to the nerve following ossiculectomy.

4. Injury to the nerve following radical mastoidectomy.

In 1930 Lewis and Dandy reported nine cases of pure lesion of the seventh nerve (peripheral) with loss of the sense of taste on the anterior two thirds of the tongue on the affected side. Among these, in five the lesion followed mastoidectomy for chronic infection of the mastoid, in one it was due to accidental injury while the eighth nerve was being sectioned for Ménière's disease, in one it was due to spontaneous complete paralysis with prodromes of pain in the mastoid region prior to the paralysis and in one it was due to an injury to the head fifteen months before examination.

Vlasto[9] in 1930, in his article entitled "The Chorda Tympani Nerve in Otology," discussed ageusia and pathologic findings in the submaxillary salivary gland resulting from operations on the tympanum. He also mentioned the possibility of parageusia with chronic suppurative otitis media.

Barnes[14] in September 1933 reported a case of parageusia associated with chronic suppuration of the middle ear and discussed the possibility that the foul taste might be due to pus passing through the eustachian tube. That the foul taste was invariably described in the same small area of the right side of the mouth and that there was an occasional return of the vile taste after a radical mastoidectomy with a dry ear seem to disprove the otitic origin. In this report no test for taste before or after the operation was mentioned. In connection with vile taste, it is interesting to note that in December 1935 Stout[15] reported

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13. Dintenfass, H.: Facial Paralysis from Acute Middle Ear Disease, Pennsylvania M. J. **38**:854 (Aug.) 1935. Hirsch, C.: Facial Paralysis in Acute and Chronic Purulent Otitis Media, New York State J. Med. **36**:430 (March 15) 1936.

14. Barnes, L.: Case of Parageusia Associated with Chronic Suppurative Otitis Media, Ann. Otol., Rhin. & Laryng. **42**:909 (Sept.) 1933.

15. Stout, Philip S.: Dry Mouth, Vile Taste, Calculus in Submaxillary Gland, Laryngoscope **45**:962 (Dec.) 1935.

a case in which the condition was of a long-standing stubborn nature but later was completely relieved after the spontaneous escape of submaxillary calculi.

Findlay [16] in February 1933 reported a case of facial paralysis with loss of taste arising from toxic inflammation of the geniculate ganglion and stressed the fact that after the removal of focal infections in the mouth and pharynx the facial palsy may be cleared up. In his case, recovery within a fortnight followed the removal of the focal infection. Loss of taste in herpes oticus was also reported by MacGibbon [17] and by Aitken and Brain.[18]

Thorkildsen [19] in April 1935 discussed ageusia following total mastoidectomy, with several interesting illustrative cases.

Szende [20] in June 1935 presented a paper on the perception of taste following operations on the ear, in which he reported forty-six cases of radical mastoidectomy, thirty-two of operation on one side and fourteen in which both sides were involved. In twenty-six cases the operation dated back from one to three years; in the other twenty cases, over three years. In the first group of patients he found ageusia in the ipsilateral anterior two thirds of the tongue. In the latter group, no deviation of the taste was found on the side operated on. He expressed the belief that in the course of years perception of taste returns on the side operated on. Since the chorda tympani nerve cannot regenerate, he assumed that the lost perception of taste is partly taken over by the chorda tympani of the good side and that the glossopharyngeal nerve with its direct fibers extends its field of innervation to the anterior half of the tongue.

Costen [21] in July 1936, in his article on "Neuralgias and Ear Symptoms Associated with Disturbed Function of the Temporomandibular Joint," reported that in twenty-two of one hundred and twenty-five cases of proved malocclusion there were pain and sensory disturbances about the lateral pharyngeal wall and the tongue. This is said to be due to irritation of the chorda tympani at its exit from the middle ear through the glaserian fissure by the loose movement of the condyle of the

16. Findlay, J. P.: Facial Paralysis Due to Toxic Inflammation of Geniculate Ganglion, M. J. Australia **1**:251 (Feb. 25) 1933.

17. MacGibbon, T. A.: Herpes Oticus, New Zealand M. J. **35**:23 (Feb.) 1936.

18. Aitken, R. S., and Brain, R. T.: Facial Palsy and Infection with Zoster Virus, Lancet **1**:19 (Jan. 7) 1933.

19. Thorkildsen, V.: Ageusia Following Total Mastoidectomy, Nord. med. tidskr. **9**:570 (April 13) 1935.

20. Szende, B.: Investigations Regarding the Perception of Taste Following Operations of the Ear, Monatschr. f. Ohrenh. **69**:737 (June) 1935.

21. Costen, J. B.: Neuralgias and Ear Symptoms Associated with Disturbed Function of the Temporomandibular Joint, J. A. M. A. **107**:252 (July 25) 1936.

mandible. One of his patients, who had complained of a copper and salt taste along the left border of the tongue for four months, was relieved by opening of the bite.

CLINICAL TESTS OF THE SENSE OF TASTE

The method of testing the perception of taste clinically is now to be considered. I used the following aqueous solutions as my testing reagents:

1. A 5 per cent solution of cane sugar for a sweet taste.
2. A 10 per cent solution of sodium chloride for a salty taste.
3. A 1 per cent solution of acetic acid for a sour taste.
4. A 1 per cent solution of quinine sulfate for a bitter taste.

I have tested a group of nurses and doctors for their taste reactions to these reagents, and I have found that the tip of the tongue is exceptionally sensitive to sweet taste and the side of the tongue is most sensitive to the other tastes. (The base of the tongue is exceptionally sensitive to bitter taste.) However, there is more or less overlapping of taste in the various areas of the tongue.

Prior to the testing of taste, an examination of the ear, nose, throat and oral cavity is done. Then the method of this test is explained to the patient. He is instructed to stick out his tongue and to keep it extended during the test. A card with the following words is held in front of him:

1. Sweet	4. Bitter
2. Salty	5. No taste at all
3. Sour	6. Peculiar (funny) taste

When the solution is applied to the tongue, the patient is asked to point out on the card what the taste is. For my first test I always apply plain water to the anterior two thirds of the tongue on the side operated on, and then to the good side to detect whether the patient is cooperating. Having determined this, I proceed with the other testing solutions in the same manner. I have found this procedure important, for if the solution is first applied to the good side and then to the affected side, the patient is often likely to think that he can perceive the same kind of taste on that side too. After each test the patient rinses his mouth with water and we gossip for a while before the next reagent is applied. In this way, the previous taste is removed from the tongue. Should the patient withdraw the tongue during the testing (often this is done unintentionally), the test has to be repeated for accurate results. For when the tongue withdraws inside the mouth, the tasting buds of the oral cavity come into action; thus a faulty result would be obtained. This examination seems to be simple, but often it is tedious and requires patience on the part not only of the examiner but of the patient. Many times my patients consider this test "funny," and after the completion of the whole examination, I am sometimes rewarded with the remark: "Thank you for your sour (or bitter) taste."

Investigations of the disturbances of taste of otitic origin were carried out on patients from the otolaryngologic service of the Memorial Hospital, including four from the City Hospital, of Worcester, Mass., from December 1936 to May 1937, with special reference to patients who had had operations on the ear, particularly radical mastoidectomy. Other conditions involving the facial nerve and the chorda tympani will also be discussed briefly. Among these are changes in the sensation of

taste on the ipsilateral anterior portion of the tongue in association with a lesion of the chorda tympani in acute or chronic otitis media, paralysis of the facial nerve in association with acute or chronic suppuration of the middle ear, ossiculectomy, paracentesis, etc. I have made tests of taste in a number of cases of acute suppuration of the middle ear before and after myringotomy, and I have not been able to detect appreciable changes in the reactions. This is because no damage is done to the chorda tympani by the myringotomy at the posterior inferior quadrant. The chorda tympani lies in a position much higher—just internal to Shrapnell's membrane near the attic region. In some cases of chronic suppuration of the middle ear I have obtained changes in the sensation of taste, and in others, none at all. This difference must depend on the effect on the chorda tympani of the pathologic changes of chronic otorrhea. When the lesion is confined to the tympanic cavity —perforation, polyp, etc.—the chorda tympani is not likely to be affected; when the lesion is in Shrapnell's membrane—marginal perforation with cholesteatoma in the attic region or partial or total necrosis of the ossicles, especially the malleus and the incus—the chorda tympani is more likely to be involved. Whatever the condition, the resistance of the chorda tympani to the infection is of paramount importance in this consideration. I have observed no case of facial paralysis arising from suppuration of the middle ear; hence no discussion can be offered from my series. Carrari [22] in 1934 discussed dysgeusia due to plugs of wax in both ears and explained the condition as a trigemino-sympathetic-facial reflex disturbance. So far, I have not been able to observe a case of such a disturbance subjectively and by the tests for perception of taste. Granted that dysgeusia may arise from such a cause, it must be of rare occurrence.

I have had the opportunity to study one case of ossiculectomy, seventeen of radical mastoidectomy, three of facial paralysis following mastoidectomy, two of modified radical mastoidectomy and a few of other conditions. In all these cases the involvement was unilateral, and none of these patients has ever subjectively noticed any change of taste. Neither did any one notice the presence of dry mouth and diminution of salivation. In persons who have undergone ossiculectomy because of the close anatomic relationship of the chorda tympani, changes in the sensation of taste are bound to occur. In those who had had a radical mastoidectomy ageusia on the ipsilateral anterior two thirds of the tongue was invariably found irrespective of when the operation was done. This was true in the cases of facial paralysis following either

22. Carrari, G.: Vertiginous Syndrome with Anosmia and Dysgeusia Due to Bilateral Plugs of Ear Wax, Boll. d. mal. d. orecchio. d. gola, d. naso **52**:234 (May) 1934.

radical or simple mastoidectomy. In the cases of modified radical mastoidectomy in which the chorda tympani is affected in one way or another, disturbances of taste rather than loss of taste appear to be the sequence.

I. ACUTE DISEASE OF THE MIDDLE EAR—ILLUSTRATIVE CASES FROM A STUDY OF TWENTY-ONE PATIENTS

CASE 1.—T. L. C., a well nourished woman of 22, was admitted to hospital for acute suppuration of the middle ear of the left side. Spontaneous rupture of the drum occurred five days before her admission. The drum was edematous, and the perforation was too small for drainage. Free incision caused the release of thin pus under pressure. The right ear was normal. Tests for taste before and after myringotomy produced a normal response on both sides.

CASE 2.—V. K., a girl of 16, was examined in the clinic on Jan. 19, 1937, with a complaint of earache on the left side following a head cold. Examination revealed bluish blisters on the wall of the canal near the tympanic membrane, which was red but not bulging. The right side was normal. The nose was congested. Treatment was conservative; the blisters were not punctured. Tests for taste produced instant response on both sides. The acute involvement of the ear completely subsided a week later. Then a second test was done. Instant response on both sides was again present.

CASE 3.—J. H. W., a man aged 53, had a discharge from the right ear of about three weeks' duration. The diagnosis was acute suppurative otitis media with acute mastoiditis. The left ear was normal. Tests before and after simple mastoidectomy and myringotomy showed no disturbance of the sense of taste.

Comment.—In this group of cases of acute disease of the middle ear there was no change in the sensation of taste, the reason being that the chorda tympani nerve was not affected either by the acute disease or by the surgical procedure.

II. CHRONIC SUPPURATION OF THE MIDDLE EAR—ILLUSTRATIVE CASES FROM A STUDY OF EIGHTEEN PATIENTS

CASE 1.—A. T., aged 14, was seen by me for the first time on Jan. 29, 1937, with a history of a running ear since the summer before. The right ear was normal. The left ear showed a mucopurulent discharge in the canal and a large central perforation of the ear drum; the handle of the malleus was mostly gone, and the short process was prominent; the whispered voice could be heard at a distance of 10 feet (3 meters). The Weber reaction was lateralized to the left; the Schwabach reaction was increased; the Rinne reaction was negative. Examination of the nose showed deviation of the septum to the left. The tonsils were moderate in size and infected. A few carious teeth were present. No local lesion of the tongue was noted. Tests for taste produced an instant response on both sides.

CASE 2.—A. B., a girl of 15, had had bilateral chronic otorrhea on and off since 1930. She had had all sorts of treatment, including ionization and the use of a powder composed of boric acid with iodine. Large central perforations of the ear drums were noted, with the handles of the malleus greatly shortened toward the tympanum. A thick, foul-smelling discharge was present. The nose appeared

to be clean, with no obstruction. The sinuses were clear to transillumination. The tonsils had been cleanly removed. The throat was clear. The teeth were apparently in good condition. Roentgenograms of the mastoids showed diffuse sclerosis without evidence of destruction. The whispered voice could be heard at a distance of about 4 feet (1.2 meters) on both sides. The patient was in a class in lip reading. Tests for taste on several separate dates showed good response on both sides.

Case 3.—G. D., a youth aged 20, was examined in the clinic on Feb. 18, 1937, this time with the complaint of buzzing in the right ear for the past six months and occasional aching. A history was given of traumatic injury to the right ear drum by the explosion of a firecracker on July 4, 1933, with immediate sharp, lancinating pain followed by bleeding. Since then he had had a discharge from the ear off and on. As far as the record shows, the perforation never healed. On examination the left ear was normal. The right drum was retracted, with a large posterior perforation exposing the incostapedial joint and the niche of the round window. Hearing was impaired on this side. The nose was congested; the tonsils were small and buried; hypertrophied lymphoid tissue was present on the pharyngeal wall, and no local lesion of the tongue was noted. Tests for taste showed that the reaction to each of the reagents was much less intense on the right side.

Case 4.—L. M., an attendant aged 28, had chronic running of the ear off and on for more than a year. In the right ear a large perforation was noted in the posterior quadrant of the drum, with a thick, foul discharge. In the left ear the drum was thin, retracted and scarred, with no discharge. In the nose the septum was markedly deviated to the right, overcrowding of the right middle turbinate was present and the middle meatus was tight. The tonsils were small and diseased. No local lesion of the tongue was noted. An examination for taste on Feb. 10, 1937, gave the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	Appreciable	Instant
Salty	Appreciable	Instant
Sour	Bitter first, then salty	Instant
Bitter	Appreciable	Instant

The patient voluntarily stated that there was some difference in reaction on the two sides of the tongue to the testing solutions. It was much less intense on the right side (affected side).

Comment.—In this group of patients with chronic suppuration of the middle ear changes in the sensation of taste were noticed in some and not in others. This difference depends on two factors—the resistance of the chorda tympani nerve to the infection and/or the effect of the pathologic changes of chronic otorrhea on the chorda tympani nerve.

III. AURAL CERUMEN—ILLUSTRATIVE CASES

Case 1.—E. W. A., a housewife aged 24, was examined in the clinic on March 12, 1937, for a complaint of hardness of hearing in both ears for about a year. Hard, pluglike cerumen was present in both ears, which were otherwise normal. The sinuses and the nose were clear. The tonsils were diseased. Tests for taste before and after the removal of cerumen gave the same positive response on both sides.

CASE 2.—R. F., a housewife aged 40, complained of aching of the left ear off and on all the winter. Examination revealed nothing unusual other than hard wax in the left ear, which was against the head of the drum. The drum was markedly retracted. Tests for taste before and after the removal of the cerumen showed equal response to the testing reagents on the two sides.

Comment.—I have questioned many patients with aural cerumen in the clinic concerning any change in the sensation of taste subjectively, and I have tested ten such patients. I have not yet observed a person with a positive change in the sense of taste.

IV. OSSICULECTOMY

CASE 1.—R. W. P., a youth aged 19, had an ossiculectomy in September 1933 for a running ear on the right side since childhood. A follow-up examination made on April 17, 1937, three years and seven months after the operation, revealed the presence of a small amount of granulation tissue and cholesteatoma in the region of the attic. This was being well taken care of by the attending otologist, so that radical mastoidectomy was not necessary. The left ear was normal. The nose and throat were clear. The tonsils were cleanly removed; the teeth were in good condition, and no local lesion of the tongue was present. There was no sensory disturbance in the distribution of the fifth and the ninth nerve. There was no complaint of disturbance of taste or of any dryness of the mouth. Tests for taste made at that time showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	Slight	Instant and intense
Sour	0	Instant
Bitter	0	Instant

Comment.—This is the only case of ossiculectomy in which I have had the opportunity to make a follow-up study. The patient showed a change in the sensation of taste on the anterior portion of the tongue corresponding to the side operated on, indicating that the chorda tympani nerve had been injured on account of its close anatomic relationship to the malleus and the incus.

V. RADICAL MASTOIDECTOMY

CASE 1.—G. D., a youth of 22, had a radical mastoidectomy on the right side in October 1936 for chronic infection of the mastoid of twenty years' duration. A follow-up examination revealed that the mastoidectomy cavity was dry. The left ear was normal. Tests of hearing showed that the spoken voice could be heard at a distance of 15 feet (4.5 meters) with the right ear and 30 feet (9.1 meters) with the left ear. The whispered voice could be heard at a distance of 6 feet (1.8 meters) with the right ear and 20 feet (6 meters) with the left. The ticking of a watch could not be heard when the watch was in contact with the right ear, but could be heard when it was in contact with the left. Tests made with tuning forks showed the lower limit of hearing in the right ear to be 512 double vibrations and the lower limit in the left ear 32 double vibrations. All the high notes and the Galton whistle could be heard on both sides. The Schwabach reaction was normal on the left, but bone conduction was increased on the

right. The Rinne reaction was positive on the left and negative on the right. The Weber reaction showed that hearing was lateralized to the right. The nose was normal except for slight deviation of the septum to the right. The throat was clear, and all the sinuses transilluminated clearly. A roentgenogram also showed all the sinuses to be clear; films of the temporomandibular joints showed no diagnostic abnormality. There was no local lesion of the tongue. The teeth were in good condition; the last molars on the right were missing (extracted).

Tests for taste made on April 7 and 14, 1937, gave the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Case 2.—H. G. B., an intelligent youth aged 17, was operated on on Oct. 16, 1936, for chronic mastoiditis, with cholesteatoma of the right ear. A follow-up examination four months after the operation revealed that the mastoidectomy cavity was dry; the left ear was normal. The nose and throat were also normal. A test for taste made at that time and another at a subsequent date gave the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Case 3.—D. P., an intelligent boy 10 years old, had a radical mastoidectomy on the right side in November 1933. When I saw him in the clinic on March 19, 1937, for the first time, there was some débris in the mastoidectomy cavity. On wiping the cavity I obtained some mucoid material. Careful examination revealed that the orifice of the eustachian tube was patent, which naturally accounts for the occasional mucoid discharge in the right ear, especially after colds. Hearing was greatly impaired in this ear. The left ear was normal. The nose, sinuses and throat were normal.

Examination for taste made at that time and again on April 16, 1937, about three and one-half years after the radical operation, gave the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Case 4.—Miss K. H. E., aged 17, was operated on on May 1, 1935, for chronic running of the left ear and chronic mastoiditis of ten years' duration. When she came to the clinic for a follow-up examination in April 1937, she was in excellent condition. The mastoidectomy cavity on the left side was dry. The right ear was normal. Hearing was slightly impaired on the side operated on. Testing with tuning forks showed the lower limit of hearing with the right ear to be 64 double vibrations and that with the left 512 double vibrations. All the other high tones and the Galton whistle were heard on both sides. The Schwabach reaction was normal on the right side, but bone conduction was increased on the left. The Rinne reaction was positive on the right and negative on the left. The Weber reaction showed that hearing was lateralized to the left. Examination of the nose, sinuses, throat, teeth and tongue gave negative results.

A test for taste made at this visit, about two years after the radical operation, showed the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 5.—G. D., a white man aged 26, was first examined by me in the clinic on April 6, 1937, and complained of the persistent running of the right ear, with some impairment of the hearing. The foul discharge had been annoying him more than anything else. He was operated on for a chronic infection of the mastoid of about three years' duration some eleven years before. Ever since the operation, the ear had been discharging a small amount of foul secretion on and off. The tonsils and adenoids were removed when he was 13. He had undergone myringotomy for abscess of the left middle ear in 1929 and in 1934. No gustatory test was ever made before. Examination revealed that the left ear was normal except for the moderate retraction of the head of the drum. The nose was somewhat congested, and the septum was deviated to the right. The nasopharynx was clear, and all the sinuses transilluminated clearly. The teeth were apparently in good condition. There was no local lesion of the tongue or any disturbance of the temporomandibular joints. The sensation over the distribution of the trigeminal and the glossopharyngeal nerve was normal. A fine mastoidectomy scar was present on the right side. The discharge in the cavity left by the radical mastoidectomy was scanty but fairly thick and fetid. After cleansing of the ear, a little granulation tissue was found to be present in the attic region. The spoken voice could be heard at a distance of 10 feet (3 meters) with the right ear and 20 feet (6 meters) with the left ear. The whispered voice could be heard at a distance of 6 inches (15 cm.) with the right ear and 15 feet (4.5 meters) with the left. The ticking of a watch could not be heard on contact with the right ear and could be heard normally with the left. Tests with tuning forks showed the lower limit of hearing to be 256 double vibrations for the right ear and 32 double vibrations for the left. All other high notes and the Galton whistle were heard on both sides. The Rinne reaction was negative on the right and positive on the left. Bone conduction was prolonged on the right but normal on the left. The Weber reaction showed that hearing was lateralized to the right. It was noted that the patient was a heavy smoker of cigarets. His sense of smell was not impaired.

A test for taste made at this time gave the followng results:

	Right (Operated Side)	Left
Water	0	0
Sweet	0	0
Salty	0	0
Sour	0	Instant
Bitter	0	Instant

I cannot explain the nondetection of sweet and salty flavors on the left side except on the ground of individual acuity to certain reagents. Whether the previous myringotomies for the then acute disease of the middle ear on the left had a subsequent effect on the taste, I am not prepared to say.

CASE 6.—C. L. D., a white woman aged 18, was operated on on Sept. 12, 1935, for chronic mastoiditis and cholesteatoma on the left side of six years' duration. Follow-up examination in April 1937 revealed that the mastoidectomy cavity was dry and the right ear normal. The spoken voice could be heard at a dis-

tance of 25 feet (7.6 meters) with the right ear and 15 feet (4.5 meters) with the left. The whispered voice could be heard at a distance of 20 feet (6 meters) with the right ear and 8 feet (2.4 meters) with the left. The ticking of a watch could be heard normally with the right ear and not at all with the left. Tests with tuning forks showed the lower limit of hearing for the right ear to be 32 double vibrations and that for the left ear 512 double vibrations. All other high notes and the Galton whistle were heard on both sides. The Rinne reaction was positive on the right and negative on the left. The Schwabach test showed normal hearing on the right and increased bone conduction on the left. The Weber reaction showed that hearing was lateralized to the left. The throat was clear; the tonsils had been cleanly removed; the teeth were in good condition, and no local lesion of the tongue was present. The sinuses were clear to light, but the right antrum was not as brilliant as the left. Hypertrophy of the right lower turbinate was present. There was a patent window to the right antrum (antrotomy had been performed).

An examination for taste made at this time, nineteen months after the radical operation, gave the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Case 7.—M. T. J., a girl aged 16, was operated on on Sept. 29, 1935, for chronic otorrhea with mastoiditis on the right side of about five years' duration. There was a large central perforation in the left drum at the same time. Follow-up examination in April 1937 revealed an unhealed central perforation with a little mucoid secretion in the left auditory canal. The radical mastoidectomy cavity on the right side was dry. The ticking of a watch in contact with the ear could not be heard on either side. Tests with tuning forks showed the lower limit of hearing on the right side to be 512 double vibrations (faint) and that on the left to be 512 double vibrations. All the other high notes and the Galton whistle were heard on both sides. The Schwabach test revealed increased bone conduction on both sides; the Weber test showed hearing to be lateralized to the right; the Rinne reaction was negative on both sides. The nose was normal except for the deviation of the septum to the right (high); the sinuses were clear to transillumination; the throat was clear; the tonsils were out; the teeth were normal, and the tongue showed no local lesion.

Tests for taste made at this time showed the following results:

	Right (Side Operated On)	Left (Chronic Otorrhea)
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Case 8.—P. J. K., a white boy aged 15, had a radical mastoidectomy on Oct. 25, 1935, for chronic running of the ear on the left side of about eight years' duration. A simple mastoidectomy had been done in January 1935 for this condition, apparently without relief. At the time of the radical operation a cholesteatoma was found to be present.

Follow-up examination in April 1937 revealed that the radical mastoidectomy cavity was practically completely epitheliated and that the external auditory canal was much stenosed. In cleaning the inferior anterior portion of this cavity, I

noted a little mucoid secretion. The patient seemed to experience no trouble from this condition. The right ear was normal. The spoken voice could be heard at a distance of 25 feet (7.6 meters) with the right ear and 8 feet (2.4 meters) with the left. The whispered voice could be heard at a distance of 20 feet (6 meters) with the right ear and 2 feet (0.6 meter) with the left. Tests with tuning forks showed the lower limit of hearing to be 32 double vibrations for the right ear and 512 double vibrations for the left. All the other high notes and the Galton whistle were heard on both sides. The Schwabach test showed hearing to be normal on the right side and bone conduction prolonged on the left. The Rinne reaction was positive on the right and negative on the left. The Weber test revealed that hearing was lateralized to the left. The nose, throat and sinuses were clear; the teeth were apparently in good condition. There was no local lesion of the tongue.

Tests for taste made in the usual manner on April 17, 1937, almost eighteen months after the radical operation, showed the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 9.—E. J. H., a woman of 20, had a radical mastoidectomy in July 1933 for chronic infection of the mastoid of eleven years' duration. This was followed by almost complete atresia of the external auditory canal. Since the threshold of hearing was so low as to be of little or no service (90 per cent loss prior to the radical operation), it was thought best to let the radical mastoidectomy cavity fill in with the granulation tissue. Follow-up examination in April 1937 revealed complete atresia of the external auditory canal on the left side. Hearing by air conduction was entirely lost on this side; hearing by bone conduction was good; the lower limit was 64 double vibrations. The right ear was normal, and hearing was excellent. The nose, throat and sinuses were all clear. Few carious teeth were present; no local lesion of the tongue was noted.

The patient was extremely well satisfied with the operative result. She was married and four months pregnant.

Tests for taste made at this time gave the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 10.—J. J. H., an intelligent boy of 13, was operated on in July 1935 for a chronically running ear with mastoiditis of about five years' duration. Follow-up examination revealed that the radical mastoidectomy cavity on the left side was covered with mucopus. The right ear, which had been discharging for about a year on and off, had a large perforation in the lower part of the drum and was covered with granulation tissue. The handle of the malleus was present. Secondary adenotonsillectomy was done in April 1935. The throat was clear; the nose was somewhat congested. The teeth were in fairly good condition; no local lesion of the tongue was noted. Hearing was much impaired on both sides. The whispered voice could be heard at a distance of 3 feet (0.9 meter) on the left side and 4 feet (1.2 meters) on the right.

A test for taste made on April 15, 1937, twenty-one months after the radical mastoidectomy, gave the following results:

	Left (Side Operated On)	Right (Chronic Running Ear)
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 11.—R. K., a white woman aged 34, had a radical mastoidectomy in February 1935 for chronic otorrhea with chronic mastoiditis on the left side of about seven years' duration. Follow-up examination in April 1937 revealed that the radical mastoidectomy cavity on the left side was clean and dry; the right ear was normal. The whispered voice could be heard at a distance of 15 feet (4.5 meters) with the right ear and 3 feet (0.9 meter) with the left. The ticking of a watch could be heard normally with the right ear and not at all with the left. Tests with tuning forks showed the lower limit of hearing to be 32 double vibrations on the right and 256 (faint) on the left. All the other high notes and the Galton whistle were heard on both sides. The Schwabach reaction was normal on the right; bone conduction was prolonged on the left. The Rinne reaction was positive on the right and negative on the left. The Weber test revealed that hearing was lateralized to the left. The nose and throat were clear; the sinuses were also clear to transillumination. The tonsils had been cleanly removed; the larynx was normal. The left upper incisor was carious; the lower molars on the right side had been extracted. There was no local lesion on the tongue.

Tests for taste made at that time, about twenty-six months after the radical operation, gave the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 12.—A. K., a man aged 29, had a radical mastoidectomy on Oct. 29, 1934, for chronic mastoiditis on the left side and osteoma of the left aural canal. Eight days after the radical mastoidectomy with removal of the osteoma of the aural canal, a skin graft was placed in the mastoidectomy cavity.

Follow-up examination in April 1937 revealed complete occlusion of the external auditory canal on the left side. The mastoidectomy scar was hardly discernible. The patient was much pleased with this result. The right ear was normal, and the hearing was good. The nose, throat and sinuses were clear. The teeth were in good condition; no local lesion of the tongue was noted.

Tests for taste made at this follow-up examination showed the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 13.—Miss M. A. T., aged 30, a clerk, had a radical mastoidectomy on Feb. 11, 1935, for chronic running of the right ear for a number of years. At the time of the follow-up examination she was in excellent health and felt "swell." The mastoidectomy cavity was completely epitheliated and dry. The left ear was essentially normal. The whispered voice could be heard at a dis-

tance of 2 feet (0.6 meter) with the right ear and 15 feet (4.5 meters) with the left. Tests with tuning forks showed the lower limit of hearing to be 256 double vibrations for the right ear and 32 double vibrations for the left. All the other high notes and the Galton whistle were heard on both sides. The Schwabach test showed bone conduction to be prolonged on the right and normal on the left. The Rinne reaction was negative on the right and positive on the left. The Weber test showed that hearing was lateralized to the right. The nose and throat were clear; the tonsils had been cleanly removed. The sinuses were clear to transillumination. The teeth were in good condition; no local lesion of the tongue was present. No sensory disturbances were noted in the region of the fifth and the ninth cranial nerve.

An examination for taste made in April 1937, a little more than two years after the radical operation, showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 14.—A. V. D., an intelligent girl 11 years old, had a radical mastoidectomy on the left side in June 1934 for chronic infection of the mastoid. A follow-up examination of this patient in April 1937 revealed that the mastoidectomy cavity was dry and clean. The right ear was normal and the hearing was good. The spoken voice could be heard at a distance of 25 feet (7.6 meters) with the right ear and 20 feet (6 meters) with the left. The whispered voice could be heard at a distance of 15 feet (4.5 meters) with the right ear and 10 feet (3 meters) with the left. The ticking of a watch could be heard with the right ear and faintly with the left when the watch was in contact with the ear. Tests with tuning forks showed the lower limit of hearing to be 32 double vibrations for the right ear and 512 for the left. All the other high notes and the Galton whistle were heard. The Schwabach reaction was normal on the right; bone conduction was prolonged on the left. The Rinne reaction was positive on the right and negative on the left. The Weber test showed that hearing was lateralized to the left. The nose was essentially normal, except for a spur on the left side of the septum; there was no obstruction to breathing. The sinuses were clear to light. The throat was also clear; the tonsils had been cleanly removed. There was no local lesion of the tongue. The teeth were in fairly good condition; the left lower first molar was carious and was to be filled by a dentist soon. The larynx appeared to be normal.

A test for taste made over two and one-half years after the radical operation on the ear gave the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 15.—M. G., an intelligent girl aged 9 years, had a radical mastoidectomy in April 1935 at the Worcester City Hospital. Follow-up examination made by me through the courtesy of the hospital revealed that the mastoidectomy cavity on the right side was still discharging mucopus. Hearing was impaired on this side. The left ear was essentially normal. The nose and throat were clear. No local lesion of the tongue was noted.

A test for taste made at this time, April 1937, two years after the radical operation, showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 16.—E. M., a man aged 26, had a radical mastoidectomy on May 3, 1934, at the Worcester City Hospital for chronic infection of the mastoid on the right side. The left ear was also discharging. Follow-up examination in April 1937, almost two years after the operation, revealed that the mastoidectomy cavity was clean and dry. There was some fetid discharge in the left ear, and when it was wiped away, a small, almost marginal, perforation in the lower posterior quadrant of the drum could be seen. Hearing was impaired on both sides. The nose was slightly congested, with crusts on the septum. The throat was clear; the tonsils had been removed.

An examination for taste showed the following results:

	Right (Side Operated On)	Left (Chronic Otorrhea)
Water	0	0
Sweet	0	0
Salty	0	0
Sour	0	Instant
Bitter	0	Peculiar taste

CASE 17.—A. B., a man, was operated on in February 1933 at the Worcester City Hospital for chronic otorrhea of the right ear since childhood. Follow-up examination on May 4, 1937, revealed that the mastoidectomy cavity was dry; the left ear was normal. Hearing was impaired on the right side. The whispered voice could be heard at a distance of 8 feet (2.41 meters) on the right side and 15 feet (4.5 meters) on the left. The ticking of a watch could be heard faintly at a distance of 1 inch (2.5 cm.) with the right ear and 12 inches (30 cm.) with the left. The nose was somewhat congested; remnants of the tonsils were present; the teeth were in fair condition, and no local lesions of the tongue were noted.

Tests for taste made at this visit showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Comment.—In this group of seventeen patients who had undergone radical mastoidectomy in which the chorda tympani nerve was destroyed, the sense of taste on the anterior two thirds of the tongue on the side operated on was invariably absent.

VI. MASTOIDECTOMY COMPLICATED WITH POSTOPERATIVE PARALYSIS OF THE FACIAL NERVE

CASE 1.—S. W., a boy aged 11 years, was operated on on July 16, 1936, for chronic infection of the mastoid of two years' duration. After the operation (radical), he had complete paralysis of the right side of the face. The nose and throat were normal. The left ear was normal. This patient has been attending the outpatient department for electrical massage of the right side of the face. Up to the time of writing there is no improvement. The mastoidectomy cavity

is dry. An examination for taste made in December 1936, five months after the radical operation complicated with peripheral paralysis of the facial nerve, gave the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 2.—W. J., a man aged 25, had a radical mastoidectomy in April 1934 at the Worcester City Hospital for chronic mastoiditis with cholesteatoma and labyrinthitis. Peripheral paralysis of the facial nerve developed. A follow-up examination in April 1937, three years after the radical operation complicated with the paralysis of the seventh cranial nerve, revealed that the mastoidectomy cavity was covered with mucopurulent secretion and that there existed a little granulation tissue in the cavity. The left ear showed signs of chronic suppurative infection. There was also a little mucoid discharge. Owing to a narrowing of the external auditory canal, no perforation of the drum could be demonstrated. The spoken voice could be heard at a distance of 15 feet (4.5 meters) with the right ear and 20 feet (6 meters) with the left. The whispered voice could be heard at a distance of 10 feet (3 meters) with the right ear and 15 feet (4.5 meters) with the left. Tests with tuning forks showed the lower limit of hearing to be 256 double vibrations for both ears. All the high notes were heard. The nose and throat showed signs of mild infection, and the nasal septum was deviated to the right. The tonsils had been cleanly removed. The teeth were in fair condition. There was no spontaneous nystagmus. Peripheral paralysis of the facial nerve on the right side still existed. An examination for taste made at this time gave the following results:

	Right (Affected Side)	Left (Chronic Suppurative Otitis Media)
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

CASE 3.—D. C. L., a well nourished, intelligent girl of 11 years, was operated on in May 1936 for chronic running of the right ear with infection of the mastoid. Complete paralysis of the facial nerve of the right side followed the simple mastoidectomy. When she was seen in February 1937, the paralysis of the facial nerve was about the same as at the beginning. The nose and throat were normal. The left ear was normal. Tests for taste on two separate occasions showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	0	Instant
Salty	0	Instant
Sour	0	Instant
Bitter	0	Instant

Comment.—Loss of taste was present in all the three cases of paralysis of the facial nerve following mastoidectomy.

VII. MODIFIED RADICAL MASTOIDECTOMY

CASE 1.—Miss N. F. K., aged 16, underwent a modified radical mastoidectomy for chronic otorrhea with chronic mastoiditis on Nov. 4, 1935. The result was excellent. Follow-up examination in April 1937 revealed a fine scar at the left

mastoid and a dry ear, with absence of part of Shrapnell's membrane. The right ear was essentially normal. Hearing was good on both sides. Tests with tuning forks showed the lower limit of hearing for the right ear to be 32 double vibrations and that for the left 32 double vibrations. All the high notes and the Galton whistle were heard on both sides. The Weber test showed no lateralization of hearing; the Rinne reaction was positive on the right; air conduction equaled bone conduction on the left side. The nose, throat and sinuses were all clear. The tonsils had been cleanly removed. The larynx was normal. Tests for taste made at this time, about one year and a half after the modified radical operation, showed the following results:

	Left (Side Operated On)	Right
Water	0	0
Sweet	Appreciable	Instant
Salty	Appreciable	Instant
Sour	Appreciable	Instant
Bitter	Instant	Instant

The patient stated that the intensity of the taste on the side operated on was much less than that on the good side.

Case 2.—J. B., a senior medical student, told me that he had a modified radical mastoidectomy on the right side at a well known clinic in Colorado some thirteen years before I examined him. The right ear had been discharging mucopurulent secretions, off and on, since then, especially after colds. Hearing was practically lost on this side. Examination revealed that the right ear drum was practically absent except the remaining Shrapnell's membrane. There was also a small perforation in the attic. Profuse mucopurulent discharge was present at the time of the examination. When the ear was cleaned with a cotton applicator, a sort of "electric shock" on the ipsilateral anterior portion of the tongue was described by the patient when the applicator touched the under-surface of Shrapnell's membrane. At the same time there was what he described as a metallic taste. The left ear was normal; the nose and throat were normal. The teeth were apparently in good condition; no local lesion of the tongue was noted.

A test for taste made in March 1937 showed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	Appreciable	Instant
Salty	Appreciable	Instant
Sour	Appreciable	Instant
Bitter	0	Instant

J. B. voluntarily stated that there was a considerable difference in the intensity of the taste between the affected side and the good side.

Comment.—In these two cases after modified radical mastoidectomy a change was present in the sensation of taste on the anterior portion of the tongue on the side operated on. This disturbance of taste instead of complete ageusia must be attributed to some change in the chorda tympani nerve.

VIII. OTHER CONDITIONS PERTINENT TO THE INVESTIGATION

Case 1.— Mrs. D. M. B., an anesthetist aged 27, had a simple mastoidectomy on the left side in June 1933, and the incus was accidently removed in the exenteration of granulation tissue in the middle ear. Two pieces of granulation tissue were found adherent to its surface. Microscopic sections showed erosion

of the incus and most of the surface covered with cellular débris. Examination of the left ear in February 1937 showed thickening and retraction of the head of the drum. The hearing was greatly impaired. The right ear was normal. There was no facial paralysis. The nose and throat were normal. Tests for taste gave the following results:

	Left (Affected Side)	Right
Water	0	0
Sweet	Appreciable	Instant
Salty	Appreciable	Instant
Sour	Appreciable	Instant
Bitter	Appreciable	Instant

The patient voluntarily commented that there was a difference in the perception of the testing reagents and stated that the intensity of the taste was much less on the left (affected) side.

Case 2.—M. L., a clerk aged 26, was operated on on May 25, 1936, for chronic running of the right ear of about twenty-four years' duration. A simple mastoidectomy and currettement of the perforation in Shrapnell's membrane were done. There was no facial paralysis. The patient was discharged as improved a fortnight after the operation.

A follow-up examination about nine months later revealed that the right ear drum was markedly retracted, with a small unhealed perforation in the membrana flaccida. Hearing was somewhat impaired. The left ear was essentially normal. The nose and throat were normal.

Tests for taste revealed the following results:

	Right (Affected Side)	Left
Water	0	0
Sweet	Appreciable	Instant
Salty	Appreciable	Instant
Sour	Appreciable	Instant
Bitter	Appreciable	Instant

According to patient's own statement, all forms of taste were less intense on the right (affected) side.

Case 3.—N. R. J., a man aged 35, was operated on in March 1936 for a running ear with subacute mastoiditis of about four months' duration and a fistula into the external wall of the auditory canal. Simple mastoidectomy with myringotomy was done on the right side. The posterior wall of the canal was taken down until the fistula was reached. This area was curetted clean, and the canal was gone over, with exposure of the incus and the beginning of the head of the malleus.

A follow-up examination in February 1937, about eleven months after the operation, revealed that the left ear was normal and the right ear drum was intact and retracted. A test for taste made at this time showed that all forms of taste were less intense on the right side (the one operated on) and that the left side responded almost instantly.

Case 4.—M. R. C., an intelligent girl aged 13, had an injury to the head from an accident in a motor car on Jan. 16, 1936. She was said to have been "stunned" for some time before her admission to the hospital. On her admission, there were bleeding from the right ear, paralysis of the right external rectus muscle with diplopia and complete paralysis of the right facial nerve involving all its branches. No mention in writing was made regarding a test of hearing and gustatory examination. After a fortnight's stay in the hospital, the patient was discharged as improved. The paralysis of the sixth and the seventh cranial nerve remained unchanged.

At a follow-up examination in April 1937, fifteen months after the injury to the head, the mother stated that the facial paralysis had cleared up in about three months from the time of the child's discharge from the hospital, and that this was followed by the complete recovery of the paralysis of the abducens nerve one month later. Up to the time of writing this patient has been in excellent health. Examination revealed no facial weakness on the right side and no diplopia. Hearing was good on both sides. The ear, nose, throat and oral cavity were all normal. Taste was normal; instant response was obtained to the different testing solutions. No other disturbances of sensation were noted anywhere.

Comment.—This case is of striking interest because the patient made an uneventful recovery from a fracture of the skull complicated with complete paralysis of the sixth and the seventh cranial nerve of the right side. That the facial nerve, the abducens nerve and most probably the auditory nerve also were affected intracranially appears to be beyond question. It is reasonable to assume that ageusia on the ipsilateral anterior two thirds of the tongue must have been present. It is equally reasonable to deduce that the sensations of taste returned on the recovery from the paralysis of the facial nerve. It would be interesting to note any change in the sensations of taste from surgical repair of the facial nerve by the so-called "Ballance-Duel" operation, in which the degenerated anterior femoral cutaneous nerve is employed as repair material.

It is important to make use of tests for taste in cases of paralysis of the facial nerve as an aid in locating the lesion. Nuclear paralysis of the facial nerve (central type) gives normal taste. In the peripheral type, whether the lesion is intracranial or in the fallopian canal—this of course includes all cases in which the disturbance is of otitic origin—there will be ageusia on the ipsilateral anterior two thirds of the tongue. In palsy arising from traumatic or pathologic conditions below the point where the chorda tympani leaves the facial nerve or peripheral to the stylomastoid foramen, there will be no loss of taste. This consideration of the anatomic relationship of the facial nerve with the involvement in any given case should always be kept in mind. Perhaps it will be fitting for me to cite such a case as an illustration.

Case 5.—C. S., an intelligent girl 11 years old, had complete paralysis of the left facial nerve of ten years' duration. This was said to have occurred from an acute illness with high fever for about four days when she was about 7 months old. There was no history of vomiting, diarrhea, convulsions or any discharge from the ear. She was examined in October 1926 in the pediatric, neurologic and otologic clinics. The history indicated central origin, but the lesion was peripheral. No roentgenogram was then taken. She was not brought back for further observation till March 1937, when her mother came to the clinic for treatment of sinus trouble. On learning the story, I requested her to bring her daughter back for a follow-up examination, which revealed nothing unusual other than the paralysis of the left facial nerve of peripheral type. The ear, nose and throat were clinically essentially normal. The sinuses were clear to transillumination. The tonsils were moderate in size but apparently healthy. One carious

tooth was to be treated soon. Hearing was good on both sides. The whispered voice could be heard at a distance of 20 feet (6 meters). Low notes as well as all the high notes and the Galton whistle were heard on both sides. Roentgenograms were taken, which showed sclerosis of the left mastoid, with a questionable cavity in the region of the antrum. The irregularity of the shadow ruled out a cholesteatomatous cavity. The right mastoid appeared normal. Tests for taste made on two separate occasions gave the following results:

	Left (Facial Paralysis)	Right
Water	0	0
Sweet	Instant	Instant
Salty	Instant	Instant
Sour	Instant	Instant
Bitter	Instant	Instant

In this case, both the hearing and the sense of taste were good; the lesion was therefore peripheral to the stylomastoid foramen or below the point where the chorda tympani leaves the facial nerve. Whether this facial palsy was of otitic origin is difficult to say, but the sclerosis of the left mastoid suggests the possibility.

CONCLUSIONS

In this small series of cases, it is shown that ageusia on the ipsilateral anterior portion of the tongue is invariably present after complete radical mastoidectomy. The chorda tympani nerve has been destroyed.

In association with paralysis of the facial nerve of the peripheral type (with the exception of a lesion below the point where the chorda tympani leaves the facial nerve) there is a loss of taste on the anterior two thirds of the tongue corresponding to the side operated on. The chorda tympani has been paralyzed in consequence.

In association with a lesion of the middle ear or after a surgical procedure for treatment of disease of the middle ear the sense of taste may be disturbed. The chorda tympani nerve is partially affected.

In cases of disturbance of taste of otitic origin, as shown in the illustrative cases, the patient has no consciousness of any such change. Yet clinical tests of taste bring out the difference. Hence, the importance of the tests is shown.

SO-CALLED PRIMARY CHONDROMA OF THE ETHMOID

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In a comprehensive report on primary chondroma of the ethmoid Lugli [1] stated that Sicard [2] published a monograph on the subject including twenty-nine observations. Heymann [3] expressed the opinion that in two thirds of the cases reported by Sicard the growth was an enchondroma of the septum or was of mixed form of extranasal origin. The site of origin of many of the tumors, their mixed character and the extent of involvement have been controversial, so that the exact frequency of the true chondroma is not known. Schwerdtfeger [4] in reviewing two hundred articles on chondroma collected forty-one instances in which the growth occurred in the nasal cavity. Schlittler in reporting an instance of "enchondroma of the nasal cavity" listed five others not mentioned by Schwerdtfeger,[4] bringing the total of authentic cases up to forty-seven.

A summary of the available essential facts concerning these chondromas of the nasal region [5] discloses the following information:

From the Veterans' Administration Facility and the Department of Pathology, University of Oregon Medical School.

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1. Lugli, G.: Condroma dell'etmoide, Arch. ital. di laring **50**:135 (June 3) 1931.

2. Sicard, J.: Des tumeurs cartilagineuses (enchondromes) des fosses nasales, Thèse de Paris, no. 235, Paris, J.-B. Ballière & fils, 1897.

3. Heymann, cited by Lannois, M.: Précis des maladies de l'oreille, du nez, du pharynx et du larynx, Paris, O. Doin, 1908.

4. Schwerdtfeger: Beitrag zur Pathologie and Therapie der Chondrome der Nase und ihrer Nebenhöhlen, Ztschr. f. Laryng. **3**:581, 1911.

5. (*a*) Podestà, E.: Sopra un caso di encondroma delle fosse nasali, Arch. ital. di otol. **38**:548, 1927; cited by Lugli.[1] (*b*) Gile, B. C.: Chondroma of the Soft Palate, Long Overlooked, J. A. M. A. **68**:1906 (June 23) 1917. (*c*) Biasoli, A.: Condroma calcificato del naso, Atti d. Cong. d. Soc. ital. di laring. **15**:91, 1913; cited by Lugli.[1] (*d*) Hopmann, E.: Enchondrom des Keilbeins, der Siebbeine und der Nasenscheidewand, Ztschr. f. Laryng., Rhin. **21**:454, 1931. (*e*)

Of the fourteen patients whose sex was reported, eight were females and six were males; the ages ranged from 11 to 60 years, with the greatest frequency in the third decade of life; the onset was gradual, the diagnosis being made by rhinoscopy or biopsy. The chondroma was found to involve the soft palate in one instance, the nasopharynx in three, the left orbital cavity in three others and the right in one (with exophthalmos). In the majority of the cases, either one or both nares were blocked, with involvement of the septum and extension upward into the ethmoid as well as backward toward the sphenoid sinus. Ten growths were diagnosed simply as chondroma, without reference to the exact origin. One was called a chondro-osteoma and was spoken of as starting in the clivus; other similar tumors were described as originating in the superior maxilla and one in the cribriform plate. Three were recognized as primary in the ethmoid and two as primary in the nasal septum. Twelve were apparently successfully removed at operation without recurrence.

Accordingly, since primary chondroma is evidently of infrequent occurrence, since the site from which the growth originates is indefinite and since it apparently develops slowly, running a benign clinical course, it seems justifiable to record the following instance.

Clinical History.—A. B. W., a white man aged 40, was first admitted to the Veterans' Administration Facility, in Portland, Ore., on Jan. 10, 1933, for a basal metabolism test. He was readmitted the following day because of the presence of puffiness of the left eyebrow, with excessive tearing due to the presence of a hard tumor at the inner canthus of the left eye. The nodule caused bulging of this eye. He stated that his trouble began with apparent swelling of the eyelid a year and a half prior to his admission. At that time his weight was 124½ pounds (56.4 Kg.), his pulse rate 122 and his blood pressure 110 systolic and 80 diastolic. An examination by an oculist disclosed protrusion of both eyes, more of the left than of the right. There was dimness of vision in the left eye, as well as marked reduction in motility. The latter was not present in the right eye. An ophthalmoscopic examination disclosed slight blurring of the margin of the disk in the right eye and obliteration of the margin of the disk and edema of the papilla and the surrounding retinal tissues in the left. There was no disturbance in hearing. The nasal septum was deflected to the left. A rather large tumor was found obliterating the posterior nasal cavity and extending downward into the nasopharynx. The mass was not found to be painful or tender. There was no

Paradzik: Ztschr. f. Hals-, Nasen- u. Ohrenh. **22**:505, 1929. (*f*) Schlittler, E.: Ueber das Enchondrom der Nasennebenhöhlen, Ztschr. f. Laryng. **10**:405, 1921; cited by Lugli.[1] (*g*) Coenen: Chondrome der Schädelbasis und deren operative Behandlung, Deutsche med. Wchnschr. **38**:1955, 1912; cited by Schlittler.[8f] (*h*) Henschen: Osteochondrom des linken Siebbeinlabyrinthes, Jahresversamml. d. schweiz. odontol. Gesellsch., 1918; cited by Schlittler.[8f] (*i*) Bakker, C., and Oudendal, A. J. F.: Ein seltenes Chondrom der Nase, Ztschr. f. Laryng. **11**: 97, 1922. (*j*) Klaue: Ein Chondrom des rechten Siebbeines, Ztschr. f. Laryng. **13**:121, 1924-1925. (*k*) Hybasek, J.: Condroma del setto nasale, Časop. lék. česk. **66**:518 (March 28) 1927.

impairment of the reflexes or of the mental condition, the patient being mentally clear, quiet, pleasant, cooperative and unemotional. A roentgen examination at this time disclosed an infiltrating tumor which contained many irregular flecks of calcium distributed through it. It appeared to arise from the posterior nasopharyngeal wall and had extended into the entire nasopharynx, with involvement of the nasal antrums and the ethmoid region. Some of the projections suggested that portions of the cribriform plate were displaced upward. The tumor was regarded as malignant, and a small portion was removed and submitted to the

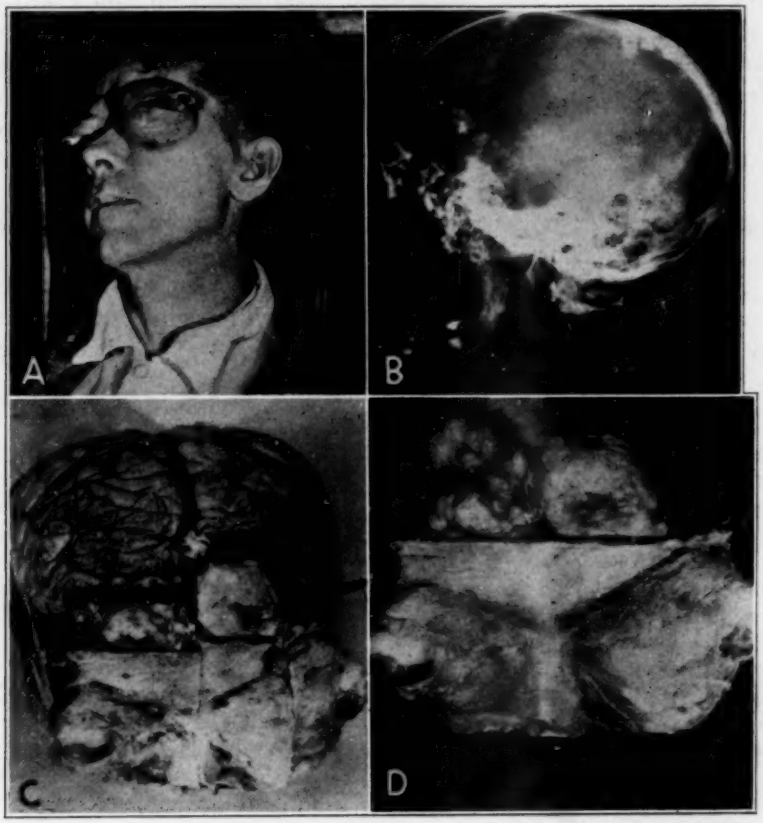

Fig. 1.—*A*, photograph of the patient, showing the marked bulging of the eyes and their position with respect to the tumor masses extending out from the orbital cavities. Note the emaciation. *B*, reproduction of the roentgenogram disclosing the increased density and the bony spicules in the tumor. *C*, photograph of the brain in situ after the calvarium had been removed. Notice the pleating of the brain and the tumor nodules extending upward in the frontal lobes as well as the position of the eyes. *D*, photograph of the general distribution of the tumor into the orbital cavities and the cranial vault, as disclosed after removal of the brain and the pericranial and facial soft parts.

pathologist, who regarded it as nonrepresentative, consisting only of cartilage. No diagnosis was made. During the stay in the hospital, observation revealed a

slight variation in temperature and a leukocyte count of 12,000, probably due to secondary infection in the nasopharyngeal region. The patient stayed in the hospital for five hundred and sixty-six days and was discharged on Feb. 26, 1935. He was readmitted to the hospital on Aug. 30, 1936, eighteen months later, because of increasing dimness of vision of the right eye. At that time he was able to recognize objects as shadows only. He had lost about 18 pounds (8.15 Kg.). He was almost completely blind (fig. 1*A*). Vision in the left eye was absent.

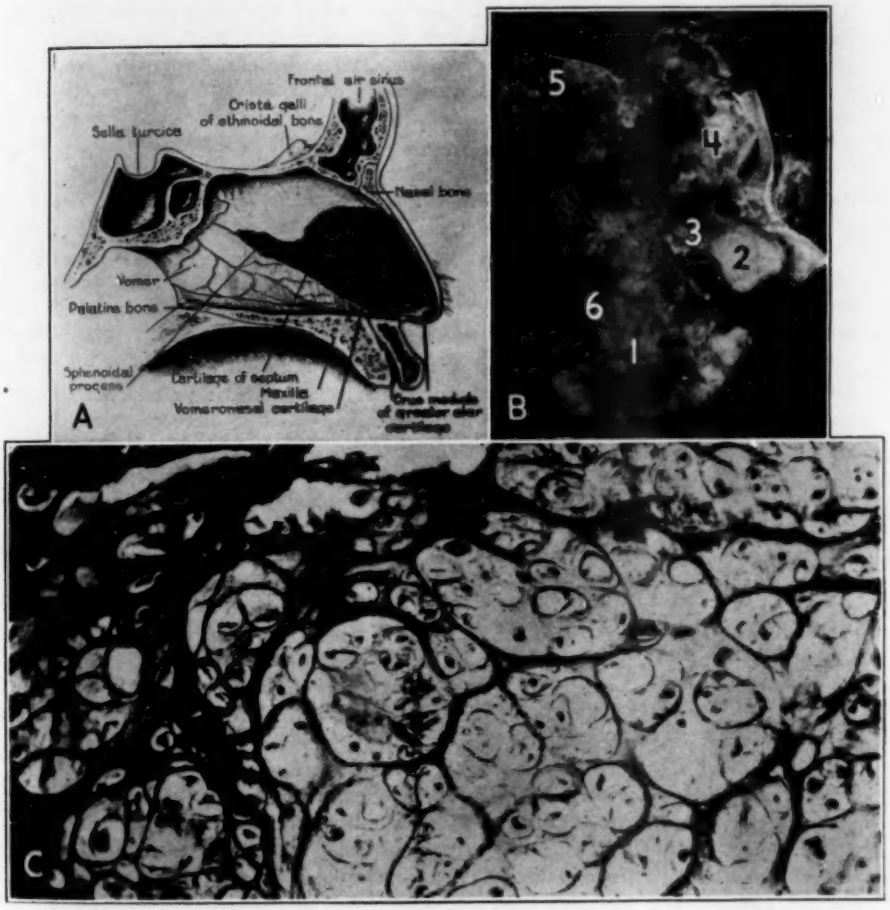

Fig. 2.—*A*, artist's drawing of the relationship of the various structures in the nasopharyngeal region, with the cartilaginous portion of the nasal septum emphasized. *B*, sagittal section through the tumor area of the nasopharynx of A. B. W. Note the bulging into the nasopharynx at *1*, the main portion of the nasal septum at *2*, the obliterative portion of the processus sphenoidalis at *3*, the involvement of the ethmoid at *4*, the extension upward into the cranial cavity at *5* and the sella turcica just back of *6*. *C*, photomicrograph of the tumor illustrating the compartments of cartilage cells, with the osteoid condensations seen in the upper left corner.

There was evidence that the tumor had extended upward beneath the anterior portion of the cerebrum. Mental disturbances were present—he howled and attempted to "make noises like a lion." Hallucinations were present, all of which were thought to be subsequent to the nasopharyngeal tumor with the production of some mental deterioration. The roentgenogram at this time disclosed marked extension of the tumor, with involvement of the bones of the face and the anterior portion of the floor of the skull. The sharp line of demarcation was lost. The tumor approached the sella turcica, which was thought to be involved (fig. 2*B*). There was a slight elevation of the temperature, which was probably due to the pyogenic infection of the orbital cavity and the nasopharynx. He became progressively mentally sluggish, with final restlessness, confusion, disorientation and an irrational state of mind. He later became semistuporous and died on Oct. 3, 1936, approximately four and one-half years after the manifestation of symptoms referable to the left eyelid.

Autopsy.—The autopsy, which was performed shortly after death, disclosed the following pertinent anatomic disturbances: primary chondroma of the nasopharynx, with extension into the cranial, oral and orbital cavities; marked bilateral exophthalmos; pressure atrophy and compression of the right and left frontal lobes of the cerebral hemispheres; pressure atrophy of the optic chiasma; a cerebellar pressure cone; moderate internal hydrocephalus; terminal hypostatic bronchopneumonia on both sides, and emaciation.

Macroscopic Examination.— The tumor in general occupied the nasopharyngeal area. It projected into the mouth through the hard and soft palate, which it completely replaced, and extended up into the orbital cavities, more pronouncedly on the left than on the right. The growth obliterated the nasal fossae and extended upward into the cranial cavity in the form of four distinct but coalescent nodular masses, with several smaller, rounded nodules projecting secondarily, being somewhat more extensive to the right of the midline than to the left. The neoplasm occupied the right frontal cranial fossa backward to the sharp margin of the lesser wing of the sphenoid bone and two thirds of the left frontal fossa, except for a small triangular portion just anterior to the left lesser wing of the sphenoid, and the left temporal fossa (fig. 1*C* and *D*). When the mass was sectioned sagittally through the center of the nasal cartilage, the various invasions could be more clearly seen. The vertical diameter of the expanse of the growth was 13 cm., about 6 cm. of which extended above the level of the sphenoid sinus and 4 cm. of which projected downward in the direction of the soft palate and the roof of the mouth. The cartilaginous portion of the nasal septum was invaded and widened, the width being 1.3 cm. There was invasion of the vertical plate of the ethmoid, with its air cells or sinuses, the sphenoid sinus and the vomer bones, with small ridgelike extensions into the basilar portion of the occipital bone beneath the sella turcica. The anterior lobe of the hypophysis appeared intact. The posterior lobe appeared somewhat cystic and degenerated. The optic chiasm was seen to lie in a semilunar slit between the posterior lobe of the hypophysis and the larger central bulging tumor mass. The internal carotid arteries were not compressed. The processus sphenoidalis of the nasal septum was completely replaced. The septal cartilage itself was uniformly invaded. Beneath the septal cartilage and the vomer, inferiorly and posteriorly, there was a pocket which contained degenerating, purulent material. It measured 2 by 1.5 by 2 cm. The frontal sinuses did not appear to be invaded. They contained jelly-like mucous material. The most expansive growth occurred in the left orbit. There was bulging at the inner canthus of the eye, which extended forward 3 cm. from the margin of the orbit. This mass, which occupied the entire orbital cavity and

which crowded the left eye forward and laterally toward the outer corner of the orbital cavity, had a lateral dimension of 6 cm., a vertical dimension of 6.5 cm. and an anteroposterior dimension of 7 cm. (fig. 2*B*). While the right eye was also crowded toward the outer canthus, the growth was not as extensive. It occupied the inner angle of the eye, but extended only to the level of the orbital ridges. The extrusion of the eye was due to the crowding forward of the contents of the orbital cavity. The eyes were accordingly spread wide apart and pushed out of their sockets, the distance between the pupils being approximately 12.5 cm. (fig. 1*A*). Section of the eyes disclosed the anterior chambers to be collapsed. There was increasing opacity of the lenses. The vitreous was in place, and the retinas also seemed to be intact. The optic nerves at the posterior surface of the eyeballs were round and apparently intact. The inner end of the right optic nerve was visible and round; the inner portion of the left optic nerve, however, was thinned and greatly flattened. The surfaces made by sectioning the tumor sagittally through the nasal septum revealed a uniform cartilaginous structure, with intervening portions of the involved bones, especially the vertical plate of the ethmoid and the vomer. The cartilaginous lobuli were relatively uniform in size, pearly gray and solid, with the exception of some tendency to cystic degeneration in the region of the ethmoid at the base of the masses projecting into the frontal cranial fossae. These masses had a transverse dimension of 9 cm. and an anteroposterior dimension of 0.8 cm. The temporal fossae were not involved. There were cavities in the frontal lobes of the brain, corresponding to the nodules of the tumor projecting into the frontal fossae. These extended backward, most pronouncedly to the right of the midline for a distance of 7.5 cm. from the tip of the right frontal lobe. Both frontal lobes were compressed, with condensation of the convolutions and obliteration of the sulci (fig. 1*C*). The optic chiasma was greatly thinned. The anterior communicating cerebral arteries, as well as the anterior frontal arteries, were greatly flattened. The recess in the right lobe extended backward about 3 cm. posterior to the corpus callosum, which it compressed somewhat to the right. The foramina of Monro were also somewhat compressed, but there was no corresponding occlusion, since the cavity of the right ventricle was not appreciably enlarged. The extension backward was less pronounced on the left side. The surfaces made by sectioning the brain disclosed no noteworthy changes except for relative anemia and atrophy of the frontal convolutions. There were no noteworthy changes in the meninges or the cerebellum. There were no metastases.

Microscopic Examination.—Sections of the tumor disclosed it to be composed largely of cartilage cells of various ages but moderately uniform size. These cells were enclosed in compartments of irregular size and shape and were separated by rather coarse fibers of myxomatous connective tissue. There were irregular, shaggy areas of bone formation. Some of these were atypical developments secondary to the formation of cartilage; others were remnants of the normal bone that had been invaded by the tumor. The cartilage cells were for the most part of the mature differentiated type. Some myxomatous degeneration was present. There were no evidences anywhere of malignant change. The process appeared entirely benign. A search of a number of sections made from different blocks failed to reveal any suggestion of a teratogenous structure.

COMMENT

It is obvious from the clinical history and the results of gross and microscopic study of the tumor as well as from the associated

pathologic conditions that it was definitely benign. The course of the neoplasm was at least four and one-half years. Whether the tumor existed prior to this time could not be ascertained. This is in accord with the information obtained from available literature, for such a tumor usually develops slowly, having an insidious onset, and is unrecognized for many years. In the case reported by Podestà [5a] the tumor was of twenty-two years' duration; in that of Gile,[5b] of twenty years', and in that of Biasoli,[5c] of seventeen years'. Minor obstructions in the nasal cavity are of such frequent occurrence that patients commonly disregard them until they become sufficiently severe to give rise to major disturbances. In the case reported here the patient did not seek aid until the tumor had invaded the orbit and had interfered with the drainage from the conjunctival sac, so that excessive tearing occurred. The subsequent clinical signs and symptoms were largely those of compression atrophy of the optic nerves, with destruction of vision and distortion of the features, with a low grade, secondary toxicity from accumulated nasopharyngeal infection. Mental symptoms were late in developing, largely because of the primary, progressive invasion of the relatively silent frontal areas. The pressure phenomena produced by the large masses extending upward into the cranial cavity did not seriously interfere with the circulation; so there were no evidences of irritability or paralysis. There were present none of the phenomena usually associated with tumor of the frontal lobe. Changes in personality were not recorded. The mental disturbances referred to in the clinical history developed only shortly before death. Up to that time the patient was cooperative and intelligent. This is all the more striking when one considers the depth to which this tumor had extended into the cerebral area. Drainage of spinal fluid was not interfered with, there was only a moderate pressure cone and the convolutions were not greatly flattened—all of which explains the absence of serious intracranial clinical manifestations. Interesting as is the correlation of the clinical and the pathologic manifestations of this neoplasia, the exact origin of such tumors is equally fascinating when an explanation is attempted. Because this general area occasionally is the location of chondroma of variable sites of origin, such as the intercartilaginous disks of the upper end of the spinal column, the nasopharynx, the palate, and the parotid glands, the so-called pure chondroma originating in the region of the nasal septum or the ethmoid has been variously classified. Lugli [1] offered the hypothesis that in a number of cases such a tumor develops primarily in the ethmoid region. In explanation of the histogenesis he stated that the ethmoid cells appear in the embryo as early as the fourth month, as the result of invaginations which form in the cartilage walls of the meatuses, that they continue to develop

until they reach a definite form and that in this development it is easy for displacement of the single cartilaginous elements to occur, with the formation of "cell rests" from which chondroma may arise. This author also expressed the opinion that this constitutes the common site of origin of the pure type of chondroma found in the nasal cavity. Such views were also expressed by Hopmann [5d] and others. Paradzik [5e] recorded an instance in a man of 45, in which the tumor arose from the cribriform plate. Lugli [1] supported the opinion that was advanced by various authors, for example, Schlittler,[5f] Schwerdtfeger [4] and Podestà,[5g] that a tumor of this type has a marked tendency to recur. However, not all authors are of that opinion, since twelve tumors were reported as successfully removed, apparently without recurrence, including the one reported by Lugli,[1] with description of the operative details. A consideration of the site of origin by the various authors reporting such chondromas must be accepted with reservations because of the lack of opportunity for complete study. Since the tumor is of long duration, it may readily be assumed that in its extension and pushing aside of tissues, together with the secondary degeneration, the point from which the growth originated may be wholly obliterated. It seems reasonable to assume that the variable manifestations produced by the invasions could yield only theoretical conclusions as to the possible site of origin. In the instance reported here, we were able, with the cooperation of the embalmer, to remove the entire area, so that the tumor could be sectioned sagittally in its entirety and the variations in penetration and modification in structure in relationship to the normal anatomic parts could be definitely ascertained (fig. 2 *A* and *B*). When the sagittal section through the nasal septum is studied in comparison with a similar section through the head showing the normal structure (illustrated in these two photographs), it will be noted that the cartilaginous processus sphenoidalis of the nasal septum is absent, having been obliterated by the chondroma. The vertical plate of the ethmoid is also seen to be invaded, while the major portion of the cartilaginous septum, although it is invaded by the tumor, still maintains its form and shape. It would seem to us, therefore, that this chondroma originated from the nasal septum and extended in a slow, progressive, symmetrical manner in various directions, guided by the various anatomic parts concerned. It is true that there were early manifestations of progression into the orbital cavity. When one considers the thinness of the bone here and the relatively delicate vertical plate of the ethmoid as well as the honeycombed character of the ethmoid air cells, it is not difficult to understand that less resistance is offered by these structures to the invasion of the neoplasm. The pattern of the tumor as seen in figure 2 *B* shows that extension occurred in three definite directions—toward the left orbital cavity, through the cribriform plate and through

the soft palate. It was from the latter that the biopsy specimen was removed, but the true nature was unrecognized at that time. If the diagnosis had been made then, the tumor might have been successfully removed.

It seems to us that in considering the origin of primary chondroma of the ethmoid, in general, the normal cartilaginous structures, such as are found in the nasal septum and the alae of the nose, should be more seriously considered. While it is true that the tumor seems to make its appearance in the early decades of life, in most instances occurring prior to the age of 40, it would seem that in the absence of excessive formation of bone the theory of the embryonic development of the ethmoid air cells as sites of origin, while possible, is less plausible and tenable.

SUMMARY AND CONCLUSION

The report concerns the slow, progressive development of a chondroma occurring in a laborer aged 44; the neoplasm was not recognized until it manifested itself in the left orbital cavity. The tumor apparently originated from the processus sphenoidalis of the nasal septum. An unusual opportunity was afforded for the study of the true nature and distribution of this tumor through the permission to remove the involved area in toto. The origin of true chondroma from the ethmoid region is questioned.

A METHOD OF CLOSING A PHARYNGEAL FISTULA FOLLOWING LARYNGECTOMY

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A pharyngeal fistula may follow any opening into the cavity of the pharynx through the tissues of the neck. Transhyoid approach to the interior of the pharynx or removal of the larynx is occasionally followed by a fistula. As a rule, the fistula closes spontaneously or after the usual plastic procedure.

The straight line incision used in the removal of the larynx, coupled with proper and adequate drainage, has helped a great deal to prevent the formation of fistulas.

The fistula is caused by loss of continuity in the pharyngeal wall. The exciting cause is devitalization of the tissues by infection.

In cases in which irradiation has been done before operation the changes in the tissue, both histologic and biologic, are such that union rarely occurs or when it does occur spontaneously, it is usually a long time postoperatively (figs. 1 and 2).

In two cases that are reported, the patients had undergone laryngectomy. Both had been treated previously by roentgen rays. In each a large fistula resulted, averaging approximately 1½ inches (3.7 cm.) in diameter.

In my experience with fistula following the removal of the larynx, methods of closure that were successful for patients who had received no roentgen therapy were complete failures when these methods of approximation were applied. Histologic studies of the tissues of these patients showed marked changes in the elemental structure of the epidermis and derma and even atrophy of the adjacent muscle tissues. The histologic changes were evident, but there was no way of estimating the biologic changes.

Attempts at uniting the edges of the fistula would result in a good-looking approximation, but without local reaction, and usually within from three to seven days a complete separation of the tissues that were approximated. After attempting many of these closures I felt that new tissue edges must be approximated and that then only would success ensue.

Read at the Fifty-Ninth Annual Congress of the American Laryngological Association, Atlantic City, N. J., May 31, 1937.

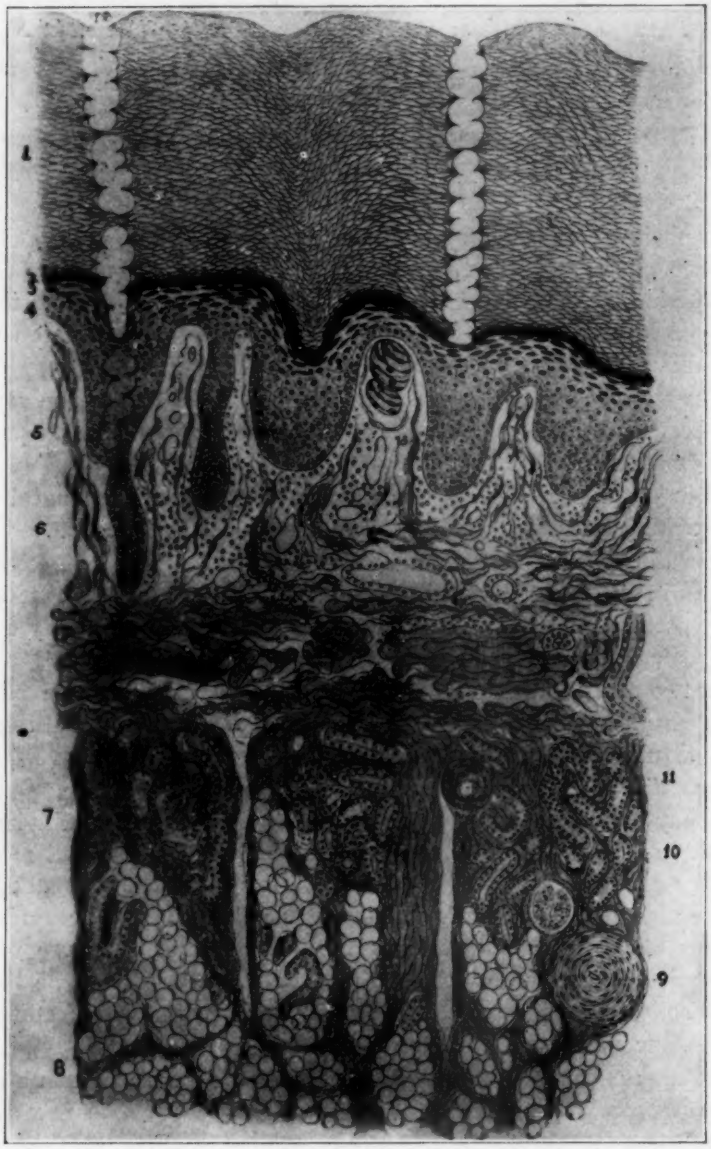

Fig 1.—Normal skin. *1* indicates the stratum corneum; *2*, the stratum lucidum; *3*, the stratum granulosum; *4*, the stratum Malpighii; *5*, the papillary layer of the corium; *6*, the interpapillary process of the stratum Malpighii; *7*, the subcutaneous tissue of a coiled sweat gland; *8*, adipose tissue; *9*, a pacinian corpuscle; *10*, sweat gland tubes; *11*, an artery; *12*, a sweat gland duct, and *13*, a Meissner corpuscle. (Reproduced from Klein, E., and Smith, E. N.: Atlas of Histology, Philadelphia, J. B. Lippincott Company, 1879-1880, p. 375, plate XLI).

Fig. 2.—Chronic roentgen ray dermatitis. There is dense, compact degenerated connective tissue, especially in the upper half of the derma and all the way down to the subcutaneous tissue. There is a paucity of vessels; those remaining are much dilated. Appendages are for the most part absent; those remaining are degenerated. The epidermis as a whole is thin; the horny layer is somewhat thickened, and rete pegs are absent. (Reproduced from MacKee, George M.: X-Rays and Radium in the Treatment of Diseases of the Skin, Philadelphia, Lea & Febiger, 1927, p. 248, fig. 145.)

In an attempt to rebuild the outer pharyngeal wall certain principles must be observed:

1. The fistula must be covered by a flap, slid and swung from neighboring tissue as far from the fistula as such a skin flap can be made without too much resulting deformity. Tube grafts may be used, but it was not found necessary in the two cases reported. New edges must be approximated.

2. Swallowing must be abolished as much as possible. This prevents the disturbance of the approximated edges and also prevents the injection of saliva into the edges. This is accomplished by the use of tube feeding and by suction or drainage by gauze to remove the saliva from the mouth.

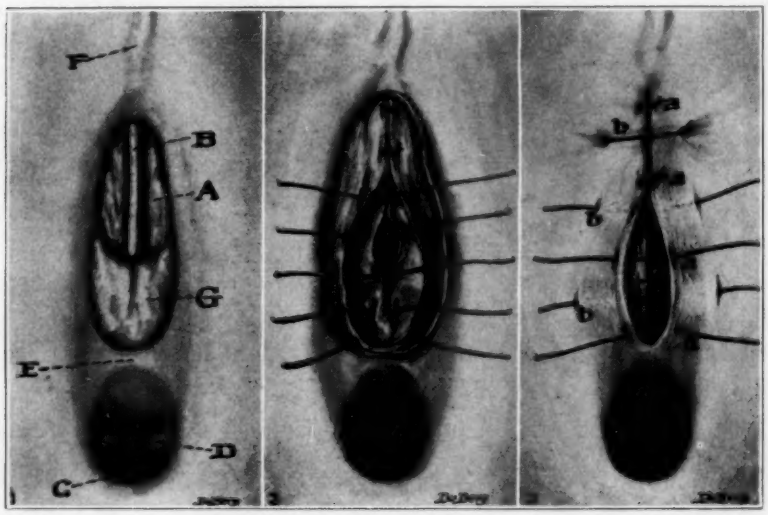

Fig. 3.—Part *1* shows a pharyngeal fistula. *A* indicates the fistula; *B*, the feeding tube; *C*, the trachea; *D*, the rings of the trachea, showing the normal absence of a cartilaginous ring posteriorly; *E*, the septum of tissue between the esophagus and the trachea; *F*, the laryngectomy incision, and *G*, granulation from the mucous membrane. Parts *2* and *3* show the usual method of closure. Part *2* illustrates the placement of the sutures. These were no. 1 chromic sutures and penetrated the wall of the esophagus. When drawn together, the mucous surfaces were turned into the lumen of the esophagus. In part *3*, *a* indicates the sutures, and *b*, the retention sutures.

The viability of the flaps must be anticipated by proper estimation of their size.

Immobilization of the structures after any plastic procedure is essential. This is accomplished by a moderately tight, well padded dressing. Failure to obliterate any dead spaces between the fascial

or muscular planes will result in infection and liquefaction. Careful approximation of the tissues aided by a moderately tight dressing accomplishes this.

The second group of illustrations, figure 3, shows the method of approximating the edges of a fistula following laryngectomy when there has been no previous irradiation. Figures 4, 5 and 6 show the method of approximating new edges and of sliding skin and muscle flaps.

REPORT OF CASES

Figures 4, 5 and 6 show the stages in the operation on a patient aged 75. Previous to laryngectomy he had roentgen therapy for a definitely diagnosed carcinoma

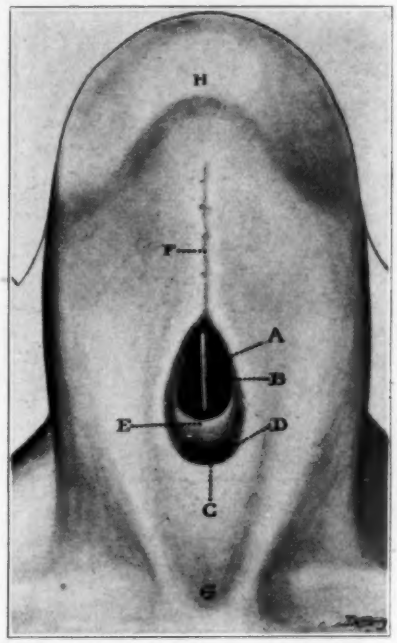

Fig. 4.—The first step in the suggested method of closure of pharyngeal fistula. This is a general view of the dehiscence, showing the lower part of the pharynx and the feeding tube in situ. *A* indicates the esophageal tube; *B* the feeding tube; *C* the trachea; *D*, the rings of the trachea; *E*, the septum of tissue—on the esophageal side, mucous membrane and on the tracheal side, epithelium; *F*, the laryngectomy incision; *G*, the jugulum, and *H*, the chin.

of the larynx. He had such severe pain after the irradiation, and the cartilages of his larynx became so necrosed that from ¾ to 1½ grain (0.048 to 0.097 Gm.) of morphine was required to give him relief during twenty-four hours. Tracheotomy had been done some months previously. He was unable to swallow, and a feeding tube was inserted. After laryngectomy a large fistula developed approximately 1½ inches (3.7 cm.) in diameter. The tissues adjacent to the fistula were

atrophied, with depigmentation but no keratosis or telangiectasia. There was a parchment-like appearance to the skin adjacent to the fistula. Five plastic closures were unsuccessful. Approximation of new edges and sliding muscle and skin flaps over the fistula resulted successfully. The laryngectomy was done on Sept. 1, 1936, at the New York Post-Graduate Hospital, and the fistula was permanently closed on Jan. 29, 1937. At the time of writing he has gained 38 pounds (17.2 Kg.); there appears to be no recurrence of the malignant process and he has acquired a buccal voice.

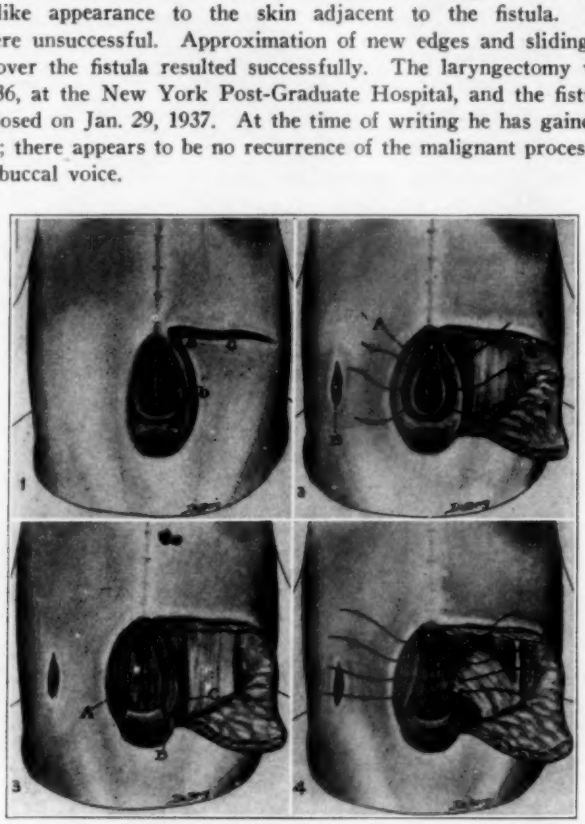

Fig. 5.—In the step illustrated in part *1* the incision was carried completely around the edge of the fistula at the junction of the skin and the mucous membrane. The esophagus was separated laterally from the surrounding tissue, so that there was no tension on the viscus. A triangular flap of skin, subcutaneous tissue and platysma muscle was then separated on the left side of the neck. The point of the flap is indicated by *a*, the vertical edge of the flap by *b* and the upper edge by *c*. The placement of sutures is shown in part *2*. These were no. 1 chromic sutures and penetrated the wall of the esophagus. When drawn together, the mucous surfaces were turned into the lumen of the esophagus. The flap on the left side is shown dissected free. The skin and subcutaneous tissues adjacent to the opening through the incision (*A*) have been subcutaneously dissected. This flap was further released by subcutaneous undermining through incision *B*. Part *3* shows the esophagus drawn together and the edges of the wound inverted after they were freed by scraping off the mucous membrane. There was considerable dead space at *A*, *B* and *C*. In the step illustrated in part *4* the dead spaces indicated at *A* and *B* in part *3* are obliterated by suturing part of the sternocleidomastoid muscle to the subcutaneous tissues of the right side. The muscle implantation not only partly obliterates the dead spaces shown at *A* and *B* in part *3* but also fills the gap between the esophagus and the skin and gives additional support to all the neighboring structures.

Figure 3 illustrates the type of closure unsuccessfully attempted for this patient.

Another patient, aged 56, had an almost identical history and had undergone roentgen treatment extended over two years. On his admission to the New York Post-Graduate Medical School and Hospital the intralaryngeal perichondritis and obstruction were marked, and it was feared that at any time a tracheotomy would became necessary. Within five days he was prepared for operation, and on Aug. 10, 1936, a laryngectomy was done for carcinoma and the necrosis following irradiation. A large fistula resulted after laryngectomy. Three unsuccessful attempts were made to close the fistula. The fourth attempt was successful; new edges were approximated, and the fistula was closed on May 1, 1937. This patient has gained 27 pounds (12.2 Kg.), and at the time of writing there appears to be

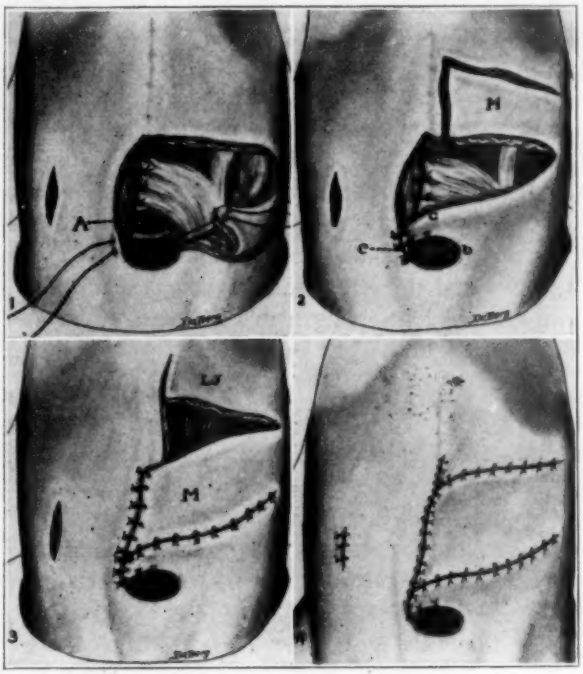

Fig. 6.—Part *1* shows the muscle flap sutured in place. At *A* there are an area of nonsupport and a dead space in front of the esophagus. Part *2* shows the skin flap from the left side sutured to the upper part of the trachea and the skin on the right side of the neck adjacent to the trachea. The end of the flap covers the dead space (*A*) shown in part *1*. This flap has been adjusted to the general dehiscence of tissues, so that the point of the flap *a* (fig. 5, part *1*) is sutured to *e*, the vertical edge of the flap encircles the upper part of the trachea at *b* and the upper edge of the flap is seen at *c*, somewhat stretched. Another flap *M* has been separated from under the chin. In part *3* the flap *M* has been sufficiently released so that it can be brought into contact with the tissues of the other side without tension and sutured in place. The exposure of subcutaneous and muscular tissue by displacement of the flap is overcome by undermining the skin to the angle of the jaw in the flap marked *LJ*. Part *4* illustrates the final step. All the flaps have been sutured in place and a compression bandage will be put on.

no recurrence. He has marked mitral insufficiency that gave considerable concern, mainly because of its presence, but other than knowing that this cardiac condition was present, he gave no manifestation of it.

SUMMARY

Pharyngeal fistula may follow any operative procedure that opens into the pharynx through the tissues of the neck. These fistulas occur after laryngectomy or transhyoid operations in the region of the base of the tongue or in the tonsillar area. They are caused by infection and devitalization of the tissues of the neck and the pharynx. The use of the median line incision and adequate drainage has overcome this complication to a great degree.

Previously irradiated tissues are not prone to unite when separated. Attempts to reunite these irradiated tissues require a long time and frequently result in an apparently unclosable fistula.

Sliding and swinging of thick flaps of skin and muscle from the tissues at the periphery of the irradiated area and approximation of new edges over the fistula are necessary to obtain a successful closure.

Swallowing must be avoided as much as possible because of the pull of the muscles and the entrance of saliva into the repaired fistula. This is accomplished by inserting a nasal feeding tube and leaving it in the esophagus until union has occurred.

COMMENT

In these cases the fistula probably would have united after a long time. The attempts to unite the edges of the fistula stimulated the formation of new blood vessels, for the early plastic attempts were bloodlessly performed; the later ones showed more blood.

The inhibition of tissue repair following irradiation must be seriously considered.

Histologically these changes may be seen, but biologically they can be estimated only by loss of ability of the tissues to unite.

BILATERAL PNEUMOCOCCIC MASTOIDITIS

REPORT OF A CASE WITH OPERATION AND SERUM TREATMENT

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The following case is reported in order to present the use of specific antipneumococcus serum in mastoiditis.

Mrs. S. S., a white woman aged 35, was examined on Dec. 30, 1936. The chief complaint was pain and diminished hearing in both ears. She had had a cold ten days before, with nasal secretion and nasal obstruction during the last four days. Acute pain in both ears had been present for the past eight hours. The temperature at 9 a. m., when she was first examined, was 98.4 F.; the pulse rate, 88. Both tympanic membranes were red and bulging. No landmarks could be made out. The nose showed obstruction, with the turbinates turgescent and with mucopurulent secretion on both sides. On transillumination the frontal sinuses appeared clear while the antrums were dark. The turbinates were shrunk with a dilute solution of cocaine; paracentesis was done on both sides with the area under local anesthesia. There was immediate profuse discharge from both middle ears, particularly the left. Ephedrine solution was prescribed for the nose. The ears continued to drain for four days, when the right ear ceased discharging. The patient was seen again on the night of Jan. 2, 1937. The temperature at that time was 100.7 F. and the pulse rate, 96. The right tympanic membrane had healed and was bulging. Paracentesis was repeated with the area under local anesthesia, with the consequent discharge of purulent serum. The ears continued to drain, with pulsation noted at the sites of perforation. The temperature varied from 98 to 101 F. On January 8 she complained of pain in the right ear, with tenderness on pressure over both mastoids. On January 10 roentgenograms of the mastoids and the sinuses were taken. The antrums and the ethmoid sinuses were cloudy, particularly on the right side; the right mastoid showed cloudiness of the cells, without definite destruction. The mastoids were of the pneumatized type. The patient was given roentgen therapy. On January 13 roentgenograms of the mastoids were repeated and showed breaking down of the cells on the right side and cloudiness of the cells on the left. Roentgen therapy was repeated. Examination showed mucopurulent secretion from both ears under pulsation and sinking of the right posterosuperior canal wall. On January 13 Dr. S. Iglauer, in consultation, advised a mastoidectomy on the right side, with the possibility of mastoidectomy on the left side to be done later. On January 14 mastoidectomy on the right side was done. The cells of the tip were large; the cell walls were broken down. A culture was taken. On January 16 it was reported that the culture showed the type I pneumococcus. The patient complained of pain and tenderness in the left mastoid. On the theory that the infection in both ears followed an acute cold and sinusitis and that the same organism was common to both ears, the

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possible beneficial effect of specific antipneumococcus serum was considered. Consequently, after appropriate cutaneous and ophthalmic tests revealed no sensitivity to the serum, 20,000 units of type I pneumococcus serum (Lederle) was given intravenously. An hour and a half later this was followed by a chill and a temperature of 102 F. The next day the secretion from the left ear had lessened. A roentgenogram revealed slight cloudiness but no destruction of cells of the left mastoid. From then on the discharge from the left ear subsided rapidly, and on January 20 the left ear was dry. The patient made an uneventful recovery. The following blood counts were made:

	Leukocytes	Polymorphonuclears, %	Lymphocytes, %	Basophilic Cells, %	Eosinophils, %	Myelocytes, %
January 13	8,750	81	15	1	1	2
January 16	10,200	77	16	2	..	2
January 17	10,500	77	16.5	1.5	..	..
January 20	8,650	67	24	..	2	2

A culture of blood taken on January 17 was sterile.

One can only conjecture as to the specific value of the serum, for after all this is but one case. That there was an actual definite therapeutic effect seems highly probable. However, one may speculate as to the actual cause of improvement of the left ear. Was it due to a nonspecific reaction or to a specific reaction, or, as in many cases in which there is involvement of both ears with operation on the worse side, did the involvement of the better ear clear up spontaneously? A search of the recent literature does not disclose a previous use of type I antipneumococcus serum for mastoiditis.

SPONTANEOUS PERFORATION OF THE WALL OF THE CHEST BY AN ASPIRATED FOREIGN BODY

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It is rather a rare occurrence for an aspirated foreign body to migrate through the lung and the pleural cavity and finally to perforate to or through the skin of the chest wall. In June 1933 I had the opportunity to see a child in whom this phenomenon took place, and my curiosity as to the frequency of this occurrence was aroused. A search of the literature, including the *Index Medicus* and the *Quarterly Cumulative Index Medicus,* from 1879 until the present time, revealed eight similar cases. Dr. Louis Clerf called my attention to two more cases reported by Samuel D. Gross and also to one reported by Dr. H. B. Graham, in which a small branch of cedar was aspirated. This child died on the eighth day following the accident. The postmortem examination showed that the foreign body had perforated the visceral pleura over the lower lobe of the left lung, the branch of cedar being found in the pleural cavity. It cannot, therefore, be listed with the cases I am reporting, as in these cases the foreign body traversed the pleural cavity and then pierced the wall of the chest.

CASE 1.—(Reported in 1818.[1]) "In 1662, Armand de Bautree, son of the Comte de Nogent, was seized with a violent fever, accompanied by a great difficulty in breathing, a dry cough, afterwards spitting of blood, sleeplessness, and great pain in the right side. A tumor at length appeared on that side, and a surgeon extracted from it an ear of barley almost entire, which was quite green, and had undergone no change. The young man on being questioned as to the period when he had swallowed this substance, stated that about two months before, being at the College of Navarre, he had plucked an ear of barley in the course of his walk, and thoughtlessly put it into his mouth, he had endeavored to draw it back, but the beard of barley so adhered to his palate that he was only able to get out a small portion, and the rest of the ear was inspired. He coughed violently at first, but immediately afterwards, and for five weeks previously to the manifestations of the symptoms, he apparently enjoyed good health."

CASE 2.—(Reported in 1818.[1]) "On the 21st of June, 1703 at Frederickstadt, a boy aged twelve years, playing with his companions in a churchyard, gathered an ear of barley and put it into his mouth. Due to an accidental cough, he unintentionally swallowed it. From that moment he became extremely ill; on about

Read at the Fifty-Ninth Annual Congress of the American Laryngological Association, Atlantic City, N. J., June 1, 1937.

1. Some Account of Lord Boringdon's Accident on July 21st, 1817 and Its Consequences, London, J. McCreery, Printer, 1818.

the 25th day a tumor appeared on his right side, which when opened, revealed an ear of barley which was extracted. The boy recovered."

Case 3.—(Reported by Larget and Lamare.[2]) A girl aged 2 years was admitted to the hospital on account of the presence of an abscess in the right thoracic region. She had been having considerable fever and was in poor physical condition. About two months prior to her admission she had been playing in a yard, and while there she had a severe attack of dyspnea, cyanosis and stridor, followed by an asthmatoid wheeze. The symptoms subsided. Several weeks later slight bronchitis developed, with fever, cough and loss of weight.

Examination.—On the posterior surface of the right side of the thorax 3 fingerbreadths below the inferior angle of the scapula and a little external to the angle, a small fluctuant area was found, which when incised discharged a quantity of pus and a small head of the grass (Trisetum flavescens) commonly known as wild oats. After the evacuation of the abscess the child's general condition improved, and she made an uneventful recovery. A roentgenogram showed the presence of localized empyema.

Case 4.—(Reported by Tanasesco.[3]) A girl aged 8 months was brought to a physician on account of an intermittently discharging fistula on the posterior wall of the chest. The mother stated that the child had choked after inhaling a head of rye. After the inhalation of the head of grass she occasionally became cyanotic, slept poorly and had fever and chills. Fourteen days later while changing the child's shirt the mother noticed that the skin over a portion of the posterior wall of the chest was red and swollen. Later this area became pointed, and the mother opened it, finding only a small amount of discharge. On the following day the mother found a foreign body in the wound. In removing it she noticed that it was a head of grass measuring 3.5 centimeters in length, which came out base first.

Examination.—The general condition was good. On the right side a discharging fistula was found in the fifth intercostal space posterior to the line of the axilla. There was no dyspnea. Absolute dulness was found extending from the base to within 1½ inches (3.7 cm.) above the abscess. Change of position did not change the dulness. Auscultation revealed that in the posterior position near the base of the lung the breath sounds were absent. Higher over the lung a bubbling sound was evident during respiration. Above and posteriorly the breath sounds were normal. The foreign body probably followed the right bronchus, perforated the pleura and then punctured the wall of the chest.

Case 5.—(Reported by Coleman and Patrick.[4]) A boy 3½ years of age was admitted to the hospital a month after he had aspirated an ear of common grass, resembling in appearance an unripe ear of barley. He had been ill at home for about two weeks, with a temperature ranging up to 103 F. On July 23 he coughed up some blood, and a swelling developed on the wall of the chest

2. Larget, M., and Lamare, J. P.: Curious Migration of a Head of Grain Through the Respiratory Tract, Bull. et mém. Soc. nat. de chir. **55**:26 (Jan. 19) 1929.

3. Tanasesco: A Very Uncommon Case of Migration of a Foreign Body in the Organism (Head of Rye), Bull. et mém. Soc. nat. de chir. **55**:388 (March 16) 1929.

4. Coleman, E. H., and Patrick, V.: An Inhaled Foreign Body Extruded Through the Chest Wall, Lancet **1**:77 (Jan. 11) 1930.

in front of the angle of the right scapula. While dressing this swelling the district nurse noticed a foreign substance projecting through the skin. She seized it with a forceps and removed what proved to be an ear of grass 1¾ inches (4 cm.) long. The child was then sent to the hospital. Examination of the chest showed the base of the right lung to be dull on percussion and the breath sounds diminished. There was a small sinus over the eighth intercostal space on the right side in the posterior axillary line. A roentgenogram showed increased density at the base of the right lung. Aspiration produced no fluid. On July 31 he had a severe attack of coughing and expectorated about a pint of exceedingly foul pus. This left him in a collapsed condition, and for three days he was very ill. On August 4 an injection of iodized poppy-seed oil was made through the small sinus. A roentgenogram showed globules of iodized poppy-seed oil resting on the upper surface of the diaphragm, but none in the pulmonary substance. It was deduced from this that most of the pus was in the pleura and not in an abscess of the lung, as had been suspected. Accordingly, a portion of the ninth rib was resected, and the empyema was drained. The temperature fell rapidly to normal, and the patient made an uneventful recovery.

Case 6.—(Reported by Juliá Rosés.[5]) A child of 16 months was brought to the physician on account of a swelling of the posterior thoracic wall, which the parents interpreted as being due to a broken rib. The physician examined the child without taking a history and found a subcutaneous swelling at the posterior axillary line on the level of the eighth rib on the right side. At the center of this area a yellowish point was surrounded by a reddish halo. The infected point was opened with a dressing forceps, and a head of grass was removed from the wound. After its removal breath sounds could be heard through the opening, indicating that the opening communicated with a bronchus. The following facts were brought out by questioning the parents: Fourteen days prior to the removal of the head of grass the child had a violent attack of coughing while playing with some grass and became cyanotic. These symptoms subsided rapidly, but on the following day a persistent dry cough developed. There was little fever. On the thirteenth day the parents noticed the thoracic prominence which they interpreted as a fractured rib. The child made an uneventful recovery.

Case 7.—(Reported by Stanski.[6]) The subject of this accident was a woman 20 years of age, a patient in the Cochin Hospital, of Paris, France. It appeared that she had labored for some time under symptoms of phthisis and that a fortnight before her admission she had inadvertently inhaled an ear of wild oats. The immediate effects of the accident were succeeded by continual convulsive coughing, and a few days afterward inflammation of the right lung set in. Copious expectoration of very fetid matter followed, and on her admission an abscess containing 12 ounces (354 cc.) of offensive pus similar to that discharged by coughing was detected in the right lumbar region. The evacuation of the abscess afforded considerable relief, but cavernous and amphoric respiration, with pectoriloquy, could be heard at the base of the right lung, and subsequently another abscess formed between the ribs a little below the inferior angle of the scapula. After this was opened, a seton was passed from one into the other, and

5. Juliá Rosés, R.: Curious Migration of Foreign Body of Respiratory Tract, Rev. méd. de Barcelona **17**:339 (April) 1932.

6. Stanski: Epi de fausse avoine introduit dans les voies aériennes et rejeté au dehors à travers des parois thoraciques: mort à la suite d'une phthisie pulmonaire, Gaz. méd. de Paris **5**:490 (July) 1837; Brit. & For. M. Rev. **7**:251, 1838.

when the tape was drawn upward the foreign substance was entangled and brought out. The sores continued to discharge for a considerable time; the hectic irritation progressed, and the woman died from phthisis seven months after her admission to the hospital. The dissection of the body revealed extensive tuberculous disease of the summit of each lung and extensive adhesions of the right lung to the wall of the chest, with the remains of a sinus leading to one of the external openings.

Case 8.—(Reported by Avery.[7]) "A child 18 months old, while amusing himself with the tops of a juniper tree, allowed a little sprig to pass into the throat. His mother, in attempting to remove it, pushed it down into the windpipe, where it immediately gave rise to the ordinary effects consequent upon such accidents. After much cough and irritation for nearly a year, an abscess formed in the right lung and at length pointed between the fifth and sixth ribs, in the vicinity of the nipple. It discharged a large quantity of thick, fetid matter, greatly debilitating the little sufferer. The part finally became fistulous and upon examining it one day the foreign body was seen in its interior, from which it was at once extracted. The child soon began to improve, but continued feebly for a long time; the right lung seemed to have been rendered totally unfit for the purposes of respiration and the corresponding wall of the chest was caved in so as to lead to serious deformity. The pectoral muscles and the muscles of the right arm were remarkably thin and flabby and even the bones on that side appeared to have been stunted in their development. This was eight years after the accident. The opposite side of the chest at this period was preternaturally full, forming a striking contrast with the affected one."

Case 9.—(Reported by Ferru and Ducos.[8]) A baby 8 months of age acquired a severe cough and dyspnea accompanied with a high fever. The pulmonary findings were negative. On the following day the dyspnea and other symptoms had decreased in severity, and on the third day the little patient seemed normal.

Two weeks later the physician was again called to see the child, who had acquired a cough, fever and a painful swelling in the posterior axillary line at the level of the eighth intercostal space. This tumefaction was hard, red and painful to touch and resembled a large furuncle. There were some râles in the chest in the region surrounding the swelling. A diagnosis of furuncle was made. On the following day the tumefaction opened spontaneously, discharging serous fluid and a head of wild grain. The mother then remembered that the paroxysm of coughing and dyspnea occurred while the child was playing on the grass in her garden.

Case 10.—(Reported by Deloriere.[9]) A girl 5 years of age aspirated a head of foxtail grass. Several days later she had a general feeling of depression or exhaustion. There were râles over the middle third of the right lung, but she was without cough or fever. Two weeks later a fistula opened between the fifth and the sixth ribs and a head of grass, which was between 6 and 8 cm. long, was expelled.

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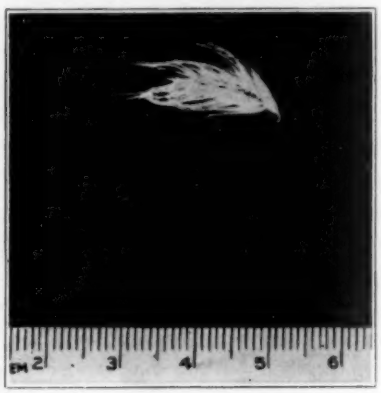
7. Avery, A. G.: Personal communication to S. D. Gross; cited in Gross, S. D.: A Practical Treatise on Foreign Bodies in the Air-Passages, Philadelphia, Blanchard & Lea, 1854.

8. Ferru and Ducos: Bronchial Foreign Body Expelled Spontaneously by the Intercostal Channel in a Nursling, Bull. Soc. de pédiat. de Paris **34**:177 (March) 1936.

9. Deloriere, cited by Ferru and Ducos.[8]

CASE 11.—The history of the case which came under my observation was as follows: A child 6 years of age had severe recurring paroxysms of abdominal pain, vomiting and diarrhea. His temperature rose to 103 F., and the white blood cell count was 20,000. A diagnosis of appendicitis was made, and an operation to remove the appendix was performed, but no pathologic changes in that organ were noted. On the following day it was discovered that definite involvement of the right lung existed, with dulness on percussion and absence of breath sounds, especially over the lateral portion of the right lung. Six days after the removal of the child's appendix a nurse discovered what she thought was a small furuncle on the posterior wall of the chest in the fifth interspace of the axillary line on the right side. After opening the infected area she saw a foreign body protruding from the wound. With a small forceps she removed what proved to be a head of grass, which protruded base first. The wound was enlarged, and drainage was established. I was consulted in reference to the necessity for bronchoscopic examination. This was found unnecessary. The child made an uneventful recovery.



The foreign body extracted from my patient.

COMMENT

Samuel D. Gross, in his book entitled "A Practical Treatise on Foreign Bodies in the Air-Passages," which was published in 1854, made the following statement: "Foreign bodies, introduced into the air passages by the glottis, are sometimes expelled through an abscess, ulcer, or fistula in the walls of the chest. Of the possibilities of such an occurrence numerous examples are upon record. Various substances may be thus disposed of after having been retained for an indefinite period in the bronchial tubes and pulmonary tissues." After this statement Doctor Gross cited two cases, one of which was reported by Doctor Stanski in the *Gazette médicale de Paris* in 1837. In this article Doctor Stanski asserted that aspirated foreign bodies frequently pass through the lung and perforate the chest wall. He stated further that he was acquainted with as many as twenty cases similar to his, which had been reported by other authors.

It seems rather difficult to believe that if Gross knew of numerous instances of this nature he would have reported only two cases, one of which was described in a personal communication from another physician. Likewise, it seems strange that Doctor Stanski should have stated that he was acquainted with at least twenty similar case reports without substantiating this statement by furnishing a list of the authors who reported them. Finally, it is hard to understand why these authors should be acquainted with such a large number of cases of this type, whereas, so far as I know, no similar case has been reported from the clinics in Philadelphia, where more than 3,300 foreign bodies have been removed from the air and food passages. It is interesting to note that in eight of the eleven cases reported a diagnosis of foreign body in the lung was not made until after the foreign body had been extracted through the chest wall. In the three remaining cases the history makes one doubt whether the cause of illness had been recognized as a foreign body in the lung.

SUMMARY

Eleven cases are reported in which a foreign body was aspirated into the bronchus, passed through the lung and the pleural cavity and presented under the skin of the chest wall.

In each instance the foreign body passed through the right bronchus and appeared between the ribs under the right wall of the chest.

In all but one case the foreign body was extruded through the posterior wall of the chest.

In ten cases the foreign body was a head of grass. In the eleventh case it was a twig from a juniper tree. All these foreign bodies, with the possible exception of the juniper sprig, have the power of spontaneous propulsion.

The shortest time which elapsed between the aspiration of the foreign body and its appearance under the skin of the chest wall was eight days and the longest one year, the latter period being in the case of the twig from a juniper tree.

USE OF UREA IN DISEASES OF THE EAR, NOSE AND THROAT

PRELIMINARY REPORT

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Ancient superstition and home remedies occasionally form a background for sound therapeutic measures. One would hardly think that the use of urine in infected wounds by primitive Africans and Asiatics might contribute to the modern development of urea therapy. The success of some investigators with urea and allantoin has stimulated work to evaluate the indications and limitations of the use of urea in diseases of the ear, nose and throat. Kaplan [1] found that by the use of allantoin, a maggot excretion, chronic indolent ulcers could be made to heal. Using urea, also a maggot excretion and a product of the hydrolysis of allantoin, Robinson [2] and his collaborators obtained similar results. Using concentrated solutions and gross quantities of urea crystals applied directly to a wound, Holder and MacKay [3] were able to reduce infection and hasten healing in cases in which other therapeutic agents were not effective.

For the most part a 2 per cent solution of urea was used. Twenty grams of crystalline urea was added to 1,000 cc. of sterile distilled water—for a 10 per cent solution 100 Gm. was added. In cases of ulcer urea was applied four times a day in saturated wet dressings. When the ulceration was deep and there was a great deal of necrotic tissue, this was supplemented by irrigations with the urea solution three times a day. For projecting carcinoma the urea was used as a wet dressing. In home treatment the urea solution was freshly prepared in the home by the addition of 1 teaspoonful of urea crystals to a glass of freshly boiled and cooled water.

A series of cases of different types is herewith reported to demonstrate the efficacy of the treatment.

CARCINOMA

CASE 1.—P. O., a white man aged 62, was admitted to the Cook County Hospital on Dec. 25, 1936, complaining of swelling in the left submaxillary region for three weeks. Examination revealed a thick cauliflower-like growth about 3 by 5 by 1 cm.

1. Kaplan, T.: Allantoin Treatment of Ulcers, J. A. M. A. **108**:968 (March 20) 1937.

2. Robinson, W.: The Use of Urea to Stimulate Healing in Chronic Purulent Wounds, Am. J. Surg. **33**:192 (Aug.) 1936.

3. Holder, H., and MacKay, E. M.: The Use of Urea in the Treatment of Infected Wounds, J. A. M. A. **108**:1167 (April 3) 1937.

beneath the tongue. On the left side of the neck externally was a mass the size of an orange, which was fungating, foul smelling and draining pus. Biopsy of the original growth and the metastases revealed hornifying epidermoid carcinoma. The pulmonary findings and the Wassermann reaction were negative. Treatment consisted of dressings saturated with a 2 per cent solution of urea, which were applied to the metastasis on the side of the neck. Relief from the foul odor was apparent in three days. There was sloughing of necrotic tissue for nine days. The wound was healed on Jan. 11, 1937. Biopsy of the area where the wound previously existed showed acanthosis and hyperkeratosis at that time, with no evidence of malignancy. A paste containing 2 per cent urea was used on the floor of the mouth with no results. There was no recurrence.

CASE 2.—J. S., a man aged 59, was admitted to the hospital almost moribund on Nov. 7, 1936. He presented a history of difficult breathing, dysphagia, and loss of weight. Physical examination revealed a gray necrotic ulcerative lesion involving a large part of the epiglottis. Examination of the sputum, a Wassermann test and roentgen examination gave negative results. Biopsy confirmed the clinical diagnosis of carcinoma of the larynx. Multiple fistulas developed on the side of the neck; the discharge was examined for organisms of mycoses. Treatment consisted of a 2 per cent solution of urea on wet dressings, with irrigations three times a day. By December 18 the wound was clean and the pus was greatly diminished. By Jan. 11, 1937, the external wound was completely healed. The patient became suddenly worse and died on January 17.

CASE 3.—J. D., aged 59, complained of cancer behind the ear of seven years' duration. Physical examination revealed a large ulceration 2.5 cm. in diameter by 2 cm. deep behind the left ear over the mastoid region. Biopsy revealed basal cell carcinoma. Treatment consisting of extensive diathermy left a lesion 4.6 by 3.5 by 1.6 cm. Urea was first applied on Jan. 29, 1937. On February 5 the wound was completely filled with healthy granulations. By March 1 the lesion was 2 by 1.7 by 0.5 cm., the healed portion being covered with epithelium. Pus and foul odor were present in the wound until urea was applied. Both disappeared two days after the application of urea and have never returned. The wound is almost completely healed at the time of writing. The last biopsy (March 8) showed slight recurrence of carcinoma.

CASE 4.—E. P., aged 43, had a hornifying squamous cell carcinoma of the nose, with complete destruction of the external nares. On March 16, 1937, considerable liquefactive necrosis was present. Urea was applied. By April 2 the slough, necrosis and pus had disappeared.

LUDWIG'S ANGINA

CASE 1.—On Jan. 26, 1937, extraction of a molar at the right mandible of C. M. was followed by swelling, pain, fever and difficulty in swallowing. The symptoms increased, and the patient was acutely ill two days later. The blood pressure was 100 systolic and 72 diastolic. The tongue was dry. There were marked gingivitis, swelling of the right peritonsillar region, pillars and uvula, and a woody swelling of the right parotid gland and the submaxillary region two thirds of the way down the neck to the midline.

The white blood cell count was 22,800, and the hemoglobin content was 85 per cent; the urine gave a 1 plus reaction to tests for albumin. The Kahn test gave negative results.

Organisms included Vincent's anaerobes, the staphylococci, streptococci and Welch bacilli.

The temperature varied from 100 to 104 F. and then dropped gradually after four days.

On January 31, the patient was very ill, irrational and dyspneic, with poor pulse and swelling to within 4 cm. above the clavicle. A therapeutic dose of gas gangrene antitoxin was given. Sulfanilamide was used intramuscularly from January 31 to February 2 in doses of 5 cc. of a 2.5 per cent solution every four hours. On January 31 the pterygomaxillary space from below the angle of the jaw was explored. The incision was 3 cm. deep and parallel to the mandible and extended to the capsule of the submaxillary glands. There were much gas and seropus on opening. Incision was made down the anterior border of the sternocleidomastoid muscle and was kept open with packing. Tube drains were inserted in the deep wound and along the pack in the incision below. The swellings subsided slowly. Diluted solution of sodium hypochlorite U. S. P. was used up to February 2. The wound was foul, with much odor and gangrene of the deep areas. Beginning on February 8 irrigations with urea were used three times a day for one week. The odor rapidly lessened. In three days the gangrenous fascia began to separate and was easily removed. The wound was healthy in five days, with good granulation. It closed rather rapidly without suture and resulted in a moderate scar, not requiring excision.

Case 2.—On Feb. 4, 1937, the patient was unable to open the jaws without provoking pain and was somewhat unstable and nervous. Two days later, after roentgen treatment, the swelling of the right jaw was increased, taking in the whole parotid region and the cheek to the dorsum of the nose. Breathing was somewhat difficult, and there was pain at times. Incision was made on February 8. The swelling had not subsided. It subsided during the next two days. There was no pain, but the area was tender. Three days later the swelling was increased and the mouth could not be opened as wide as before. There was no difficulty in breathing. On February 15 irrigation with a 5 per cent solution of urea was started. The swelling was subsiding, and there was drainage of greenish pus. Breathing was easy, and there was no pain. The appetite was developing. On the next day the patient had a choking sensation and dysphagia. The wound continued to drain for the next eleven days. On February 26 there were pain and swelling in the right jaw again. A small abscess was opened on the right side of the jaw, and a large amount of pus was evacuated. The wound continued to drain, and by March 6 only a small amount of serous discharge was noted. On the following day there were swelling in right lower maxillary region and a lump in the inner surface of the right lower gum. Compound solution of sodium borate N. F. was used as a mouth wash. Two days later there was no drainage. The wound was closing, and the general condition was improving. The general impression was that although there was more copious discharge from the wound than usual, it subsided much more quickly than was expected.

MAXILLARY SINUSITIS

Case 1.—O. B. presented a history of chronic maxillary sinusitis of many years' duration. Pus was washed from both maxillary sinuses. A series of four irrigations with a 2 per cent solution of urea gave no relief. Definite relief was obtained from operation on both antrums.

Case 2.—A. L. gave a history of recurrent maxillary sinusitis. The maxillary sinuses were washed with a 1 per cent solution of urea. Recurrence took place as soon after washing as it had after the use of other solutions.

CERVICAL ADENITIS

CASE 1.—B. A., aged 17, presented the complaint of cervical adenitis of two weeks' duration. The area became fluctuant and was incised, with the release of much pus. Irrigation was done three times a day with a 2 per cent solution of urea. Purulent discharge stopped in two days, with rapid subsidence of fever and uneventful recovery.

CASE 2.—P. S., aged 34, had a history of cervical adenitis of one week's duration, following erysipelas. Spontaneous opening into the canal of the ear occurred. The ear was irrigated daily with a 2 per cent solution of urea. Drainage stopped after four weeks.

OTITIS MEDIA

CASE 1.—H. B., aged 53, complained of a discharging ear since childhood. Physical examination revealed total defect of the tympanic membrane, associated with mucopurulent discharge. The lining of the middle ear was red, with no granulations. The ear was treated with boric acid-alcohol drops three times a day for two weeks with no results. A 2 per cent solution of urea was then instilled into the ear three times a day. At the end of a week the ear was dry. The membrane of the middle ear appeared normal. There were no exuberant granulations. The ear remained dry for two months, when a fresh cold produced drainage again. Discharge stopped when the cold went away.

CASE 2.—G. C., aged 6 years, presented otitis media of the bone-invading type. There was a history of discharge from both ears for four years following scarlet fever and radical mastoidectomy of the right ear. On Jan. 5, 1937, treatment was instituted with the instillation of a 2 per cent solution of urea in both ears. On January 23 there were less odor and discharge from the right ear. Foul discharge from the left ear continued. On January 30 the right ear was almost dry. Foul-smelling discharge from the left ear persisted. Consistent treatment of the left ear produced no beneficial results. Radical mastoidectomy was performed.

CASE 3.—A. H., aged 17, presented a history of granulations and foul discharge from the right ear of many years' duration. Treatment consisted of the removal of polyps and granulations followed by the instillation of a 2 per cent solution of urea. At the end of six weeks the discharge was still foul and there was no other improvement in the ear.

CASE 3.—L. S., aged 9 years, presented a history of scarlet fever, with mastoiditis and simple mastoidectomy. There was intermittent discharge from both ears. On Jan. 13, 1937, there was practically no discharge from either ear. A 2 per cent solution of urea was instilled in both ears. On January 27 a head cold produced a foul discharge from both ears. At that time the ears were treated with boric acid-alcohol drops. On March 6 the odor had disappeared and the ears were almost dry.

MASTOID WOUNDS

CASE 1.—J. L., aged 50, presented a history of streptococcic meningitis. Treatment consisted of extensive mastoidectomy, with uncovering of the middle and posterior fossae. On the fifth postoperative day the wound was wide and gaping, with much necrotic material at the edges and foul discharge. Dressings saturated with a 2 per cent solution of urea were applied. The odor disappeared in one day, all necrotic tissue disappearing in two days. The wound is healing rapidly at the time of writing.

CASE 2.—C. V., aged 6 years, presented a history of mastoidectomy on both sides. On the ninth postoperative day there was a large fistula, 8 by 8 mm. Treatment with a 2 per cent solution of urea in irrigations and dressings was begun. At the end of the week the fistula was reduced in size by one half.

CASE 3.—V. L., a white girl aged 12 years, was first examined on Aug. 14, 1936. She had a history of an operation for acute mastoiditis at another hospital one year before, which left her with a postauricular fistula. She had been treated since the time of her operation, the physician removing particles of bone from time to time. Examination on August 14 revealed a postauricular incision, with a fistulous tract in its upper third. She also had enlarged tonsils and adenoids. She returned in the latter part of November 1936, and the tonsils and adenoids were removed on November 27. Since that time she has been having inflations of her ear. Treatment with a urea solution (2 per cent) was started in this fistulous tract by instillation and packs. Four months have elapsed, and for the last thirty days before the time of writing the fistula has been closed.

SUMMARY AND CONCLUSIONS

A 2 per cent solution of urea is apparently beneficial in reducing metastases in certain types of infected necrotic carcinoma; its value for infected wounds of the ear and throat and infected wounds of the neck and the floor of the mouth parallels the excellent results in the treatment of infected wounds in other parts of the body. Its specific effects seem to be: (1) elimination of odor, (2) proteolysis of necrotic tissue and (3) stimulation of granulation and epitheliation.

A more comprehensive study of this substance seems to be indicated to observe its value as a therapeutic agent.

Drs. T. C. Galloway, H. E. Davis, S. A. Friedberg, Alfred Lewy, L. T. Curry and P. J. Wolf permitted me to report cases in which they have used urea.

PARALYSIS OF THE FACIAL NERVE

REPORT OF A CASE

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Injury of the facial nerve is a distressing complication of infection of the mastoid and of mastoidectomy. Gowers [1] stated:

> In complete facial palsy, the muscles of the affected half of the face become toneless and immobile. In all movements, voluntary or emotional, the affected half of the face is still. The two sides of the face present a strange incongruity and the smile or frown deprived of half its range loses more than half its character so that it is difficult to recognize the expressional significance of the distorting contractions of the cheek and brow which occur on the unaffected side.

The work of Ney [2] and later that of Ballance and Duel [3] have shown that the injured or completely interrupted facial nerve can be readily exposed in its canal. Depending on the lesion found, it can be decompressed or an end to end suture can be done or a bridging nerve graft used to unite the ends of the nerve when they are widely separated.

This brief report of a case is presented to emphasize the simplicity of the exposure of the nerve in its canal and to point out the value of the decompressive type of operation.

REPORT OF CASE

J. T., a mechanic 42 years old, was admitted to the hospital on June 5, 1935. For the preceding seven days there had been severe pain in the right ear. The right drum was reddened, and the posterosuperior quadrant bulged. Paracentesis was done immediately, and a pure culture of type III pneumococci was grown from the pus. Though drainage was free for the next eight days, he did not improve, and on June 13 a simple mastoidectomy was carried out. The cortex was intact. The air cells, widely distributed, were filled with gelatinous material and pus. As the aditus was approached, the canal of the facial nerve was encroached on, and it was realized that the nerve had probably been damaged.

From the otolaryngologic service, Royal Victoria Hospital, Montreal, Canada.

Dr. William Cone, neurosurgeon to the Montreal Neurological Institute, assisted in observation and in conducting this case to its present satisfactory conclusion.

1. Gowers, W. R.: A Manual of Diseases of the Nervous System, London, J. & A. Churchill, 1888, vol. 2, p. 217.

2. Ney, K. W.: Facial Paralysis and Surgical Repair of the Facial Nerve, Laryngoscope **32**:327, 1922.

3. Ballance, C., and Duel, A. B.: Operative Treatment of Facial Palsy by Introduction of Nerve Grafts into the Fallopian Canal and by Other Intratemporal Methods, Arch. Otolaryng. **15**:1 (Jan.) 1932.

When all cells were removed, the wound was packed with iodoform gauze. As soon as the patient recovered from the anesthesia, complete paralysis of the facial musculature on the right side was noted.

It was decided that the facial nerve should be exposed in the canal as soon as the acute infection subsided. Material was taken from the wound at frequent intervals for culture, and that taken on July 1 showed no growth of pneumococci.

On July 5 the canal was opened with a mallet and chisel from close to the stylomastoid foramen to the genu. It was necessary to remove the incus and the malleus to expose the upper bend of the facial nerve. Near the stylomastoid foramen the nerve was white and appeared to be normal. Above this it was reddish brown and swollen. At the point of injury it was contused and softened and partially torn on one side. Central to this point of trauma the nerve appeared to be normal. One fine catgut suture was taken through the torn perineurium to approximate loosely the separated torn part of the nerve. The wound was lightly packed with iodoform gauze soaked in liquid petrolatum.

Photographs of the patient on March 15, 1937, showing voluntary movement (*A*) and emotional movement (*B*).

The immediate postoperative course was satisfactory. Careful daily dressings were carried out in the hospital until July 20, when the patient was discharged with the wound well granulated. He reported to the outpatient department for dressings and observations through August and September, until the wound had healed and the middle ear was dry.

The nerve was injured on June 13. It was decompressed and sutured on July 5. On December 22, one hundred and seventy days after the operation, the first evidence of return of volitional movement was recorded.

SUMMARY

In the past, paralysis of the facial nerve was accepted passively by the otologist. The procedure of anastomosis of the facial nerve with the hypoglossal or the spinal accessory nerves produced uncertain results

and left a great deal to be desired. Suture of the facial nerve along the lines established by Ballance and Duel offers much better results.

The operation is a simple one; approach by a radical mastoidectomy was advocated by Ballance, but in my case a complete radical mastoidectomy was not done, so that a healed membrane now protects the middle ear.

In the course of the postoperative treatment all supplementary measures that help should be adopted. Electrical treatments, massage and elastic support to keep the facial musculature from stretching are indicated. Practice in front of a mirror was carried out by this patient for ninety minutes daily for one year. Reeducation of the facial muscles must take place slowly.

Clinical Notes

IMPROVED OTOSCOPE AND OPHTHALMOSCOPE

Louis K. Pitman, M.D., New York

Within the last three years the otoscope has been greatly improved and made more practical. The speculum holder is no longer a fixed unit but is adjustable, and does not permit the source of light to obstruct the field of vision. The specula are made glareless, assuring good light on the objective.

However, most of the sources of light on the otoscope have a fixed focus, which is not practical when the speculum carrier is adjustable, for the concentrated rays of light cannot always be focused in the center of the sight opening, and one has to depend on peripheral light rays for illumination. To overcome this diffi-

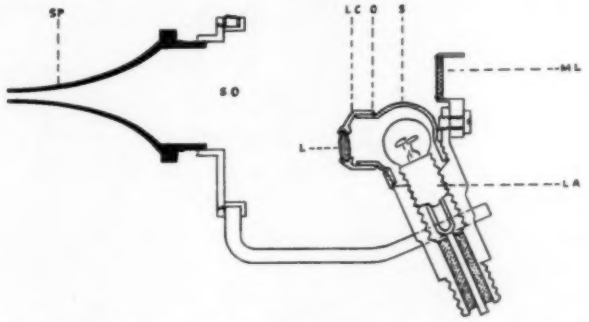

Fig. 1.—Cross-section of the otoscope head. *LA* indicates the lamp, *ML* the magnifying lens, *S* the shield, *O* the opening for the light rays, *LC* the lens carrier, *L* the lens condenser, *SO* the sight opening and *SP* the speculum.

culty, I have invented an adjustable spot light fixed to the instrument carrier. It permits the operator to focus the light at a desired angle. The principle is simple. The focusing lens is adjustable in a new way.

In figure 1 the source of light is a light bulb (*LA*) secured directly to the end of the instrument carrier. It is covered by a fixed shield (*S*) held in place to the end of the instrument carrier by threads or by frictional engagement. The shield is removable to permit replacing the lamp but is otherwise not adjustable. It has a tubular opening for projecting light rays in the direction of the sight opening (*SO*). A tubular lens carrier (*LC*), holding a lens slightly off center and at a slant, fits over the outer surface of the tubular opening. When the lens carrier is rotated, the position of the lens changes, permitting adjustment of the spot light. It is not necessary to have the lens both off center and at a slant; one variation alone may be enough to carry out this aim.

The ophthalmoscope is a universal instrument used by every member of the medical profession and is familiar to all. The instrument until recently needed

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two improvements. The first difficulty, which has now been overcome, was the inability to know the number of the lens in the dark. The Welch Allyn Company has improved this feature by incorporating an illuminated dial in their ophthalmoscope. My substitute for this feature is a touch system, which enables the operator to know what lens is in the sight opening at any time.

The second feature is an instantaneous lens finder. The present ophthalmoscope has about twenty-six lenses, and to place the proper lens at the sight opening delays operation, for one has to watch the index opening for the proper number to appear.

Figure 2 shows the face of my improved ophthalmoscope, with a cross-section of it alongside. There is a disk (*M*) in the center, which is the exposed part of the

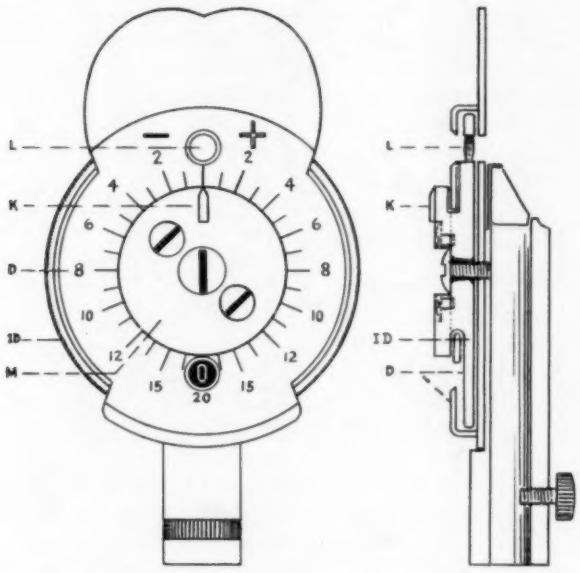

Fig. 2.—The ophthalmoscope head, with a cross-section alongside. *L* indicates a lens in the sight opening, *M* the disk holding the knob (*K*), *D* the shield carrying the dial for the corresponding lenses and *ID* the rotatable lens carrier.

lens carrier disk (*ID*). This disk (*M*) is rotated along with the lenses. The knob (*K*) is fixed and elevated on the disk (*M*) and is in the same peripheral position as the lens (*O*). The shield (*D*) is stationary and covers all lenses except at the sight opening (*L*) and also carries an elevated dial index (*D*), properly spaced and visible. The indexes for the plus lenses in this case run clockwise and for the minus lenses counterclockwise. In order to place the lens wanted at the sight opening, it is necessary only to aline the knob (*K*) to the proper index. This can also be done by sense of touch. All landmarks on the face of the dial may also be marked with phosphorescent material or by perforations communicating with the lamp.

115 West Eighty-Sixth Street.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

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THE PARANASAL SINUSES

SAMUEL SALINGER, M.D.
CHICAGO

While the literature for 1936 reveals nothing revolutionary or startling, it is nevertheless significant in demonstrating a trend toward a saner appreciation of the basic anatomic and physiologic data which have become available in recent years. Rhinologists are coming to realize more and more that empiricism and dogma are things of the past and that success depends on a full knowledge of the many factors involved in the etiology. There seems to be developing a more wholesome regard for every part of the nasal mucosa, which is manifesting itself in a tendency to conservatism in treatment, both medical and surgical. While there is still some difference of opinion regarding the relative merits of specific surgical procedures, evidence is accumulating from reliable sources, which in the long run may serve to clear up these differences and bring about more unanimity on these points.

At this time it is most satisfying to note that the extremists are fewer than formerly and that even from remote places and small centers the articles appearing in the journals show evidence that physicians are abreast of the times.

ANATOMY

Kasper's [1] paper on the nasofrontal duct based on the dissection of 100 specimens from adults and 15 from late fetuses demonstrates that in 62 per cent of the cases the "nasofrontal connection is not directly related anatomically to the ethmoid infundibulum." Such a direct connection was found in only 38 per cent of his cases, divided as follows: In 4 per cent the connection was anatomically direct, while in 34 per cent an "infundibular cell located in the ventral portion of the ethmoid infundibulum appears to be responsible for the origin of the frontal sinus." In 57 per cent the connection had its genesis in a frontal pit or furrow, while in only 3 per cent the duct was a direct extension of the frontal recess. The author demonstrates the fact

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1. Kasper, K. A.: Nasofrontal Connections, Arch. Otolaryng. **23**:322 (March) 1936.

that the duct becomes more and more tortuous and inaccessible the farther back the cell or furrow from which the sinus originated. This has an important bearing on drainage, since the more ventral the origin the shorter the duct and the freer the drainage while the more dorsal the origin the more likely that the expansion of ethmoid cells in their growth will encroach on the duct and interfere with its function. Since a wide difference in the extension of the middle turbinate anteriorly was demonstrated, it brings home the important fact that unless it is cut away close to its lateral attachment free access to the duct may not be obtained and subsequent adhesions may defeat the operation.

Van Alyea [2] made a study of the ostium maxillare in 163 adult specimens and found it located in the posterior third of the uncinate groove in 117, or 71.8 per cent. It is significant to note that in 41 cases the ostium was buried so deeply in the infundibulum and so protected by a high uncinate wall as to make it inaccessible to probing; in 12 cases a low overhanging bulla and in 18 cases a narrow hiatus offered the same unfavorable conditions. In 31 cases (19 per cent) it was impossible to cannulize the opening, in 68 (43 per cent) catheterization was difficult but possible and in 64 (39.3 per cent) it was easy. "With these may be included 25 with available accessory apertures, which brings the total of those easy to probe to 89, or 54.6 per cent." These findings are important to the clinician, who frequently blames himself for being unable to catheterize all patients and resorts to force, whereas if he would recognize the anatomic factors mentioned he might realize the futility of the effort and go back to the inferior meatal puncture for patients who are difficult to cannulize.

Dehn [3] shows 2 lateral roentgenograms of the skulls of a gorilla and a chimpanzee which demonstrate that the prominent supra-orbital ridge is not due to a large frontal sinus, as is the case in the human acromegalic skull, but is caused by a horizontal placement of the fused inner and outer tables, behind which lies a small triangular sinus. This contour is similar to that seen in the orang-utan and the gibbon, neither of which possesses a frontal sinus. The author believes that these studies are important in comparative anatomy and that examination of fossil skulls, especially of the pithecanthropus, is necessary to fill in the gap in the present knowledge.

On the basis of a large number of observations through the various embryologic stages of the human fetus, Richter [4] came to the conclusion

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2. Van Alyea, O. E.: The Ostium Maxillare, Arch. Otolaryng. **24**:553 (Nov.) 1936.

3. Dehn, O.: Zur Frage ueber die Stirnhöhlen bei Menschen und Anthropomorphen, Fortschr. a. d. Geb. d. Röntgestrahlen **54**:92 (July) 1936.

4. Richter, H.: Grundsätzliches über die Entwicklung der Nasennebenhöhlen, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **141**:54, 1936.

that the development of the sinuses depends on the inherent power of the mucous membrane to invade the embryonic bone and is therefore fully in accord with Witmaack's theory of the development of the mastoid, which is in every way comparable.

Sindoni [5] made a study of the sphenoid sinuses in 250 heads of persons of all ages. He found the average age at the time of appearance of the sinuses to be 5 years and large sinuses to be present in 60 per cent of the entire group. In from 2 to 4 per cent the roof of the sphenoid sinus was extremely thin, and in a few cases the mucous membrane was directly adherent to the dura. In 8 per cent of children under 3 years the craniopharyngeal canal was open, and 1 such anomaly was seen in a child of 5 years. The author expresses the belief that the absence of a sphenoid sinus in childhood brings the anatomic structures of the nasopharynx into closer relationship with the hypophysis than later in life and because of vascular connections inflammations in this region may have some influence on the pituitary gland. He sees the hypophysial syndrome of psychic depression, somnolence, disturbances of memory and deficient calcium metabolism as a frequent result of an infection arising by way of the vault of the pharynx. Long-continued irritation from a local pathologic condition may eventually lead to degeneration of the gland and permanent pituitary disturbance. The early and adequate development of the sinus, therefore, may have much to do with preventing such complications.

Coulouma and his associates [6] observed in 2 of 16 specimens studied that there was a prolongation of the sphenoid sinus into the lesser wing. The optic nerve encased in a thin bony wall ran through the medial portion of the cavity. The alar prolongation constituted a cavity more or less shut off from the remainder of the sinus, which would favor retention of secretions. The effect on the nerve in the event of infection is obvious.

The lymphatic pathways from the frontal sinuses to the meninges were studied by Chiara and his associates,[7] who injected colloidal preparations of thorium into the mucosa of the frontal sinuses of dogs. Histologic sections and roentgenograms demonstrated the diffusion of the injected material by way of the lymphatics extending into the meninges, the convolutions and the sulci of the brain.

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5. Sindoni, M.: Studio anatomico della regione rinofaringea-sfeno-sellare e sua importanza nella patologica, Arch. ital. di otol. **47**:864 (Dec.) 1935.

6. Coulouma, P.; Bisiaux-Aufort, and van Varseveld, F.: Le prolongement optico-alaire du sinus sphénoïdal, Echo méd. du Nord **4**:732 (Oct. 27) 1935.

7. Chiara, G.; Caponnetto, A., and Nicotra, A.: Tentativi di visualizzazione radiolografica delle vie linfatiche tra i seni frontali e le meningi, Radiol. med. **22**:1092 (Dec.) 1935.

An interesting study on pneumatization in twins based on roentgen findings is presented by Dillon and Gourevitch.[8] They examined 24 pairs of twins, 11 of them identical and 13 fraternal. Their results are tabulated as follows:

	Frontal Sinuses		Maxillary Sinuses	
	Identical	Fraternal	Identical	Fraternal
Complete similarity	5	6	6	5
Small difference	3	4	5	7
Great difference	3	3		

They conclude: "The analysis of the data obtained permits us to come to the conclusion that the paratypical factors are predominant in the origin of the diversity in the shape and in the pneumatization of the nasal accessory sinuses."

Shea[9] contributes a brief review of the essential facts with reference to the development and structure of the different sinuses. The clinical importance of this knowledge is clearly defined in various connections. He points out the importance of recognizing the encroachment of an ethmoid cell on the supra-orbital area, thus duplicating the frontal sinus and blocking the nasofrontal duct, a common cause of frontal headache. He also calls attention to the significance of such a cell in the presence of fracture when it is necessary to determine the presence or absence of involvement of the posterior wall of the frontal sinus which would make external drainage imperative. The danger of injuring the permanent tooth buds in children when operating through the canine fossa is well emphasized, as is the fact that incomplete pneumatization may leave cancellous bone above the root of the cuspid, a frequent location of beginning osteomyelitis.

Schaeffer's[10] article is too detailed for a brief abstract. It deals with well worked out evidence of the embryology of the various sinuses and considers the sinuses at various ages, the relationship of the maxillary sinus to the teeth, the concept of the ethmoid field, supernumerary and complex sinuses, the maxillary ostia, the nasofrontal duct and the relationship of the sphenoid sinus to adjacent structures. It is an excellent résumé of a large subject.

PHYSIOLOGY

Larsell and Fenton's[11] experiments on cats are significant in pointing out the probable route of infection from the sinuses to the pulmonary

8. Dillon, I. G., and Gourevitch, I. B.: Research on the Pneumatization of the Nasal Accessory Sinuses and of Mastoid Processes and on Shape and Dimensions of Sella Turcica in Twins, Am. J. Roentgenol. **35**:782 (June) 1936.

9. Shea, J. J.: Morphologic Characteristics of the Sinuses, Arch. Otolaryng. **23**:484 (April) 1936.

10. Schaeffer, J. P.: The Clinical Anatomy and Development of the Paranasal Sinuses, Pennsylvania M. J. **39**:395 (March) 1936.

11. Larsell, O., and Fenton, R. A.: Lymphatic Pathways from the Nose, Arch. Otolaryng. **24**:696 (Dec.) 1936.

structures. They injected various dyes under the mucosa of the frontal sinus and the pharyngeal walls and found that the material was carried along the following paths: (1) sinus lymph spaces and small lymphatics, (2) retropharyngeal and deep cervical lymph nodes, (3) cervical lymphatics, (4) subclavian vein, superior vena cava and right side of the heart and (5) the pulmonary capillary bed. From there the dyes were diffused through the capillary endothelium, where they were phagocytosed by septal cells "some of which become detached as alveolar dust cells" which "migrate into the perivascular and peribronchial lymphatics in the interior of the lung and into the pleural lymphatics from the outer portion of the lung." All these lymphatics drain into the bronchial and mediastinal lymph nodes, which become enlarged, as do the lymph follicles along the pulmonary bronchial walls. Alveolar "dust cells" were also found discharged with mucus directly into the bronchial passages. Direct aspiration of the injected material was prevented by tracheotomy and plugging. In addition, the intestinal route of absorption was eliminated by a special experiment of feeding the dye. Autopsy failed to reveal any granules reaching the lungs, kidneys or spleen.

Ide [12] removed the cervical sympathetic ganglions of guinea-pigs and studied the changes that appeared in the sinuses, the most conspicuous of which were those affecting the glandular structure. Trophic disturbances were noted, with shrinking, increase in round cells and development of connective tissue. The epithelial cells, the vascular apparatus, the bony structures, the olfactory epithelium and the Bowman glands were unaffected. The author expresses the belief that the elimination of the sympathetic innervation in the nasal cavities may play a rôle in the development of ozena.

Kuntz' [13] investigations confirm Head's theory that referred pain in the shoulder, arm or neck due to a lesion in the nose or sinuses is a localizing pain, because anatomic data show that "afferent components of the upper thoracic spinal nerves traverse the plexuses on the common and internal carotid arteries and reach the membrane of the nose." He explains the mechanism involved as follows: "Impulses arising at the site of the lesion in the nose are conducted into the spinal cord through afferent components of the upper thoracic nerves, reach the corresponding ganglia of the sympathetic trunks through preganglionic neurons, and are conducted to the periphery through sympathetic neurons. Pain receptors at the periphery are stimulated; the impulses arising in them are con-

12. Ide, H.: Ueber die durch Halssympathektomie erzeugten Veränderungen in den Nasenhöhlen des Kaninchens, Ausz. z. Otol. (Tokyo) **40**:13, 1934.

13. Kuntz, A.: Pathways Involved in Pains of Nasal and Paranasal Origin Referred to the Lower Cervical and Upper Thoracic Segments and the Upper Extremity, Ann. Otol., Rhin. & Laryng. **45**:394 (June) 1936.

ducted into the spinal cord through afferent components of the corresponding spinal nerves and upward through the lateral spinothalamic tract on the contralateral side."

By boring holes in the teeth of a dog's upper jaw and filling the cavities with colloidal thorium dioxide, Hatano [14] was able to trace the pathways of absorption through the pulp of the teeth. Histologic examinations showed that the mucosa of the sinuses is in direct communication with the pulp of the teeth by means of the lymphatics. Lymph channels originating in the pulp anastomose with those of the periodontium, and the latter flow toward the lymph channels of the gums and the infra-orbital canal to the submaxillary glands, while some of them penetrate the tiny canals of the bony upper jaw, forming a lymphatic network, the branches of which pass along the bony channels of the blood vessels from the bone to the antral mucosa, where they unite with the lymphatic system of the latter.

Carcò [15] performed some interesting experiments on a man who had a permanent external opening in his frontal sinus, the result of being kicked by a horse. A rubber plug was tightly clamped to the opening and attached to a tube leading to a manometer hooked up to an instrument through which it was possible to record the slightest variation of air pressure within the sinus. Recordings were made under all possible conditions, such as normal and forced respiration, coughing, sneezing and swallowing. The results showed that every change of air pressure anywhere in the respiratory tract was felt within the sinus, the tracings on the graph following closely the positive and negative phases throughout. Each particular act produced its own characteristic curve.

The reverse of this experiment—a study of effect of varying air pressure within the sinuses on the respiratory cycle—was made by von Deseo and Fodor,[16] who used an extremely complicated apparatus and finally came to the conclusion that the air pressure within the frontal and ethmoid sinuses has no influence on respiration.

PATHOLOGY

Buhrmester and Wenner [17] examined nasal polypi, nasal mucosa and nasal secretions for the presence of histamine. Extracts were made and

14. Hatano, K.: Eine experimentelle Studie über die durch die lymphatischen Wege austretende Sinuitis maxillaris dentalis, Ausz. z. Otol. (Tokyo) **40**:122, 1934.

15. Carcò, P.: Sulla partecipazione seno frontale dell'uomo alle modificazioni della meccanica respiratoria, Fisiol. e med. **6**:1035 (Dec. 20) 1935.

16. von Deseo, D., and Fodor, L.: Ueber den Einfluss der Stirnhöhle auf die Atmungsregulation beim Hunde, Arch. f. d. ges. Physiol. **236**:554, 1935.

17. Buhrmester, C. C., and Wenner, W. F.: Presence of a Histamine-Like Substance in Nasal Mucosa, Nasal Polypi and Nasal Secretion, Arch. Otolaryng. **24**:570 (Nov.) 1936.

injected into cats, and the effects compared with those obtained with standard solutions of histamine. They showed that polypoid tissue contains more histamine than the normal mucosa. Nasal secretion from allergic persons contained much less histamine-like substance than did polypi. Histaminose was not found in allergic persons with nasal disease. The authors suggest that "the increase in the mineral content of the nasal discharge, with its resulting effect on permeability, difference in potential and acid-base equilibrium, are factors to be considered in studying the formation of polypi and other allergic manifestations."

Glutz [18] refers to the work of Kartagener and Ulrich [19] on the relationship of bronchiectasis to sinusitis. In a series of 70 cases these authors found disease of the sinuses present in 55.7 per cent. They also discovered that the frontal sinuses were smaller than those in a series of patients whose lungs were normal, and they concluded that there was constitutional underdevelopment of the sinuses along with that of the bronchi, which caused the simultaneous appearance of disease in these two locations. Glutz expresses the opinion that the size of the sinus has nothing to do with the incidence of chronic infection or with the complication of bronchiectasis. A roentgen study of 100 skulls showed that the size of the frontal sinus in the presence of chronic infection of the antrum is no different on the average from that under normal conditions and could therefore not be used as an indicator of a special constitutional anomaly.

Skillern [20] reports 12 cases of osteogenesis of the bony walls of the frontal sinus due to trauma from an intranasal operation, probing or chronic infection. The process may be the result of thickening of the deeper layers of the mucoperiosteum, with metaplasia into osteoid tissue and subsequent calcification. The anterior walls and floor of the sinus are usually the seat of the process, which may progress to the point at which it obliterates the cavity. Roentgenograms in such instances are commonly misinterpreted, and the diagnosis of absence or underdevelopment of the sinus is erroneously given out. Such a diagnosis should be under suspicion when the opposite sinus is normal and the involvement ends sharply at the intersinus septum. Lateral films will show the dense bone of the affected side through the clear healthy sinus, and the involvement is of such a degree as cannot be caused by pus or a

18. Glutz, A.: Untersuchung über die Grösse der Stirnhöhlen bei Sinuitis maxillaris chronica und acuta, Ztschr. f. Hals-, Nasen- u. Ohrenh. **39**:498, 1936.

19. Kartagener, M., and Ulrich, K.: Zur Pathogenese der Bronchiektasien: Bronchiektasien und Veränderungen der Nasennebenhöhlen, Beitr. z. Klin. d. Tuberk. **86**:349, 1935.

20. Skillern, S. R.: Obliterative Frontal Sinusitis, Arch. Otolaryng. **23**:267 (March) 1936.

thickened membrane. Such a condition gives rise to persistent headache and radiating pains and will yield only to thorough eradication by means of an external operation.

Podestá and Tato [21] conceive of caseous sinusitis as an attempt at spontaneous cure of purulent sinusitis through calcification of the pus. Although the cure does not take place, the resultant accumulation may lead to erosion of adjacent walls, with invasion of neighboring structures, secondary infection and serious complications. In all the cases reported by the authors the process was of long duration, and the extent of involvement ranged from a simple accumulation of pus in the antrum which was cured by repeated irrigation to invasion of the orbit resulting in orbital abscess and necessitating radical surgical intervention. In some instances the accumulated masses resembled cholesteatoma and the sinus cavity was found to be lined with a matrix of squamous epithelium, indicating metaplasia of long standing.

Brownell [22] reviews the experimental and clinical work done by numerous authors on regeneration of the mucous membrane and states that conclusive evidence points to complete regeneration of the mucosa, including the ciliated epithelium, in sinuses operated on. The process requires from three to five months. "The type of cells composing the regenerated lining depends, in part at least, on its source, for while the epithelium is usually of stratified columnar type and comes from the nasal mucosa it may be of stratified squamous type and come from the buccal mucosa."

BACTERIOLOGY

Woodward [23] found that cultures of material from the sphenoethmoid region in 64 cases of low grade sinusitis revealed a hemolytic staphylococcus in 75 per cent, a nonhemolytic staphylococcus in 72 per cent, Streptococcus viridans once, a hemolytic streptococcus 4 times, the type II pneumococcus once, the type IV pneumococcus 5 times, Bacillus influenzae 3 times, Micrococcus catarrhalis 4 times and nonpathogenic bacteria occasionally. He expresses the belief that all staphylococci in common possess one exotoxin "which presents various biologic effects and not hemolytic leukocytic necrotizing and lethal toxins as was formerly supposed." He advises determining the antitoxin content of the patient's serum by hemolytic methods and expressing the result as a titer of so many units. In 340 consecutive estimations he found the average to be 3.2 units per cubic centimeter. He also found the most

21. Podestá, R., and Tato, J. M.: Consideraciones sobre varios casos de sinusitis caseosas y sus complicaciones, Rev. Asoc. méd. argent. **49**:1525 (Oct.) 1935.

22. Brownell, D. H.: Postoperative Regeneration of the Mucous Membrane of the Paranasal Sinuses, Arch. Otolaryng. **24**:582 (Nov.) 1936.

23. Woodward, F. D.: The Staphylococcus in Relation to Sinusitis, Bronchitis and Bronchiectasis, Arch. Otolaryng. **24**:753 (Dec.) 1936.

marked clinical improvement in patients treated with toxoid of which the titer was below 1.6 units. The author feels that staphylococcic infection when predominating is more likely to cause serious complications than streptococcic infection and advises treatment with staphylococcus toxoids and antitoxin. He also advises transfusions from a donor whose blood has a high antitoxin titer for the staphylococcus.

Studies by Enlows and Alexander [24] over a period of twelve years afforded an opportunity for comparative analysis of the bacteriologic findings in chronic maxillary sinusitis. Their observations demonstrated the value of direct microscopic examination of exudates for comparison with growths obtained on culture mediums. They were able to prove definite pathologic changes in the antrums washings from which disclosed characteristically clear and albuminous secretion. In material from 166 patients, they found Str. viridans in 72 instances (43 per cent), a pneumococcus in pure culture in 23 (14 per cent) and Streptococcus pyogenes in 14 (9 per cent). In 34 cases the secretion was of the clear albuminous type.

DIAGNOSIS

Batson and Ennis [25] contribute two articles covering substantially the same ground. As a result of numerous roentgen studies they call attention to the various extensions of the maxillary sinus and their importance in relation to the teeth and other neighboring structures. They recommend intra-oral or occlusal films in addition to the usual projections, because they avoid overlapping shadows and confusion that may arise from the vascular network about the roots of the teeth. With the patient sitting, the occlusal film is placed horizontally with its long axis anteroposterior and its short diameter extending from the midline to the distended cheek. The central ray is directed to the infra-orbital foramen in a parasagittal plane with the tube displaced 10 to 15 degrees forward from the vertical plane to avoid overlapping by the supra-orbital ridge. This projection shows clearly the bony channels frequently classed as pathologic areas and also aids in the differentiation of palatal cysts. Among the various extensions of the maxillary sinus, they call particular attention to the alveolar, palatine, infra-orbital and tuberosity extensions. The infra-orbital extension forms a pocket between the infra-orbital canal and the internal wall of the sinus, which in the postero-anterior projection casts a shadow over the nares and the eth-

24. Enlows, E. M. A., and Alexander, S. A.: Bacteriologic Studies in Acute and in Chronic Maxillary Sinusitis, Arch. Otolaryng. **23**:665 (June) 1936.

25. Batson, O. V., and Ennis, L. M.: A Roentgenological and Anatomical Study of the Maxillary Sinus, Am. J. Roentgenol. **35**:586 (May) 1936. Ennis, L. M., and Batson, O. V.: Variations of the Maxillary Sinus as Seen in the Roentgenogram, J. Am. Dent. A. **23**:201 (Feb.) 1936.

moid cells and may be misinterpreted as an abnormal lesion. The tuberosity extension may reach down and thin out the region between the root of the second and that of the third molar. The thin intervening plate may give way in the extraction of these teeth and leave a large opening. Furthermore, the alveolar ridge remains flat and offers little support for a denture. Another interesting finding demonstrated by the authors is that in senile edentulous patients recession of the alveolus causes the floor of the antrum to rise, so that it frequently reaches the level of the floor of the nasal chambers, thus entirely eliminating the alveolar recess. The importance of diagnosing septums in the sinus is duly stressed, because they frequently confuse the picture and are often the cause of inadequate drainage.

In an attempt to determine the accuracy of the preoperative roentgen diagnosis, Shannon [26] made a study of roentgenograms of 296 patients who had undergone a radical operation on the antrum. In 130 cases chronic sinusitis with marked mucosal thickening was found at operation, confirming the preoperative diagnosis in 127. In 106 cases in which polypi had been diagnosed on the films the operation corroborated the diagnosis. In 22 cases frank pus was diagnosed by the films and found at operation. The author expresses the belief that iodized oils are rarely necessary and may even "obscure . . . the condensing osteitis seen in cases of chronic suppuration and the rarefying type commonly associated with chronic polypoid degeneration." He points out how important it is to detect the increase in density of the bone which may be found even early in the development of empyema, because it may be the "sole means of differentiating between empyema and a retention cyst entirely filling the sinus, or between an antrum containing polyps and one that harbors both polyps and pus." He mentions also the importance of taking films in the upright position when the presence of fluid is suspected. In a few borderline cases in which the films disclose only a minimal osteitic reaction and doubt exists as to the necessity for operation, filling with a radiopaque solution may reveal an associated polypoid degeneration of the mucosa, which would clarify the problem. The author offers some valuable hints on the diagnosis of artefacts and the appraisal of faulty technic due to overexposure or underexposure.

Manges [27] finds that stereoscopic views are of greater value than single views. He advises displacing the tube in the sagittal plane for anteroposterior exposures and in the coronal plane for lateral exposures. He also believes it advantageous to take the pictures with the patient in the upright position.

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26. Shannon, E. H.: The Radiologic Investigation of the Superior Maxillary Antrum, J. A. M. A. **106**:599 (Feb. 22) 1936.

27. Manges, W. F.: Roentgen-Ray Diagnosis of Accessory Sinus Disease, Pennsylvania M. J. **39**:404 (March) 1936.

Barmwater [28] is a firm believer in the value of contrast mediums and cites a number of illustrative cases. He recommends a water-soluble mixture which has the advantage of a low osmotic pressure, which is less irritating to the mucous membrane. He advises irrigating the antrum and drying it with air before instilling the contrast solution.

Ribbing,[29] describing the methods used in Uppsala, Sweden, states that he has found the use of contrast mediums superfluous and claims that in sinuses free from fluids he has no difficulty in making out variations in the thickness of the mucosa, polypi, etc. In the forehead-nose projection he suggests placing the forehead on a small pillow to prevent flattening the nose and distorting the picture. The tube is tilted 30 degrees posterior to the vertical plane, and the main ray is directed to the root of the nose. Two pictures are taken with the tube 7 degrees to either side of the sagittal plane. This is done to project each ethmoid labyrinth slightly to one side, thus avoiding its being overlapped by the nasal shadows. He varies the bitemporal projection by shifting the tube 10 degrees forward from the usual position, so as to project the two frontal sinuses in line rather than superimposed. The latter procedure is useful for children, because it also furnishes a view of the nasopharynx and helps outline the adenoids.

Mittermaier [30] goes to the other extreme in the matter of contrast mediums and advocates the use of a heavy mixture. He recommends a mixture of barium lactate in tragacanth. This is introduced through the middle meatus through a catheter by means of a heavy syringe. The head is moved in various directions to facilitate the spread of the mixture over the walls of the sinus. Air is then forced in to expel the excess of the solution, leaving a layer of it adherent to the walls. The author claims by this method to outline exactly the various contours of the lining, which show up vividly by contrast with the remaining air space.

Samuel and Bowie [31] favor both the 107 degree postero-anterior Granger position and the mentovertex position of Hirtz for studying the sphenoid sinus. The former gives the best information as to the upper part of the sinus but cannot give the lateral extent of the sinus or much information regarding the septums. The authors prefer the chin-vertex position (rather than the reverse), projecting the shadow

28. Barmwater, K.: Röntgenuntersuchungen der Kieferhöhlen nach Injection mit Kontraststoff, Hals-, Nasen- u. Ohrenarzt. **27**:5, 1936.

29. Ribbing, S.: Ueber die Röntgenuntersuchung der Nasennebenhöhlen, Upsala läkaref. förh. **41**:369, 1935.

30. Mittermaier, R.: Zur Reliefdarstellung polypös-entarteter Schleimhaut der Nebenhöhlen, Hals-, Nasen- u. Ohrenarzt. **27**:2, 1936.

31. Samuel, E. C., and Bowie, E. R.: Roentgenographic Study of the Sphenoid Sinus, New Orleans M. & S. J. **88**:632 (April) 1936.

of the mandible away from the line of the sphenoid sinuses. They claim that it requires not much more exposure than the 23 or 107 degree position and can be used by increasing the voltage slightly. They say that it is important to know the location of the intersinus septum so as to differentiate a small sphenoid sinus from a posterior ethmoid cell. The last-mentioned projection was found satisfactory in 90 per cent of their cases.

Smith [32] has modified the Rhese position by directing the tube about 10 degrees above and behind the upper border of the pinna. The patient's face is placed so that the tip of the nose, the chin and the malar bone are in contact with the cassette. It has an advantage over the Rhese position in "projecting the entire ethmoid labyrinth above the dense line running from the crista galli to the sella turcica, and also it prevents superimposing of the two labyrinths, which occurs with the Rhese position.

Fricke [33] recommends Pfeiffer's axial verticosubmental projection for the sphenoid sinuses. The patient lies prone with the chin elevated from 6 to 10 cm. from the table and supported by the cassette. Even stout persons can tolerate that much extension. The central ray passes through the vertex. This position brings the sinuses nearer the film than any of the other positions, with a minimum of distortion. In addition, there is less overlapping of the posterior ethmoid sinuses and the posterior ends of the turbinates. Therefore, the lateral extensions of the sinuses show up much better.

Farjat and Canale [34] go into much detail in describing the verticomental projection through the open mouth, as developed by Prof. C. E. Koch at the Central Radiologic Institute, of Köln, Germany. Koch's own description was abstracted in last year's review of the literature.[35]

Richards [36] constructed an apparatus for the mechanical registration of opacity or translucence of the antrum. He uses a "Briggs transilluminator, activated either by direct or alternating current, in such a way that the voltage can be accurately controlled and maintained at a constant reading." A photo-electric cell within a metal container is placed in the mouth in such a way that the opening in the metal is directed against

32. Smith, F.: Roentgen Study of the Spheno-Ethmoid Sinuses, Arch. Otolaryng. **24**:762 (Dec.) 1936.

33. Fricke, K.: Das Roentgenbild der Keilbeinhöhle, Röntgenpraxis **8**:217 (April) 1936.

34. Farjat, F. P., and Canale, J. C.: Ventajas de la proyección de Koch en la representación radiográfica de todos los senos cráneo-faciales incluyendo el seno esfenoidal, Rev. Asoc. méd. argent. **50**:252 (Feb.) 1936.

35. Salinger, S.: The Paranasal Sinuses, Arch. Otolaryng. **24**:204 (Aug.); 343 (Sept.) 1936.

36. Richards, L.: A Study in Transillumination, Ann. Otol., Rhin. & Laryng. **45**:307 (June) 1936.

the floor of the antrum. The minute changes of current emanating from the cell are amplified by means of a two stage direct current amplifier. The dial, or ammeter, which is very sensitive, is set at 10, which corresponds to absence of light, and the readings taken after exposure run all the way to zero, which is the limit of translucence. The advantages of the machine are self-evident. Human interpretation of the degree of opacity is eliminated, and an accurate measurement recorded by the ammeter can be designated for future comparisons and can be interpreted by those who read the record. Experimentally, it was found that this method is superior to roentgenograms in differentiating the degrees of opacity of varying amounts of fluids (pus and serum) placed in containers. It was shown that serum, such as is found in a typical cyst, is definitely less opaque than pus. Transparent fluids, such as water and clear mucus, offered no interference to the passage of light.

Delobel [37] considers osteoperiostitis of the superior maxilla of dental origin one of the common causes of error in the diagnosis of maxillary sinusitis. Transillumination in 2 cases which he reports showed the antrum to be dark. He observed, however, that while the cutaneous aspect of the lower lid fails to be illuminated, the conjunctival surface lights up, and this can be made out even more definitely if the lid is pulled outward; the sulcus is then illuminated as a crescent against the dark fringe of the lashes. This is due to the fact that the light passes readily through the normal antrum, whereas it is blocked out by the osteoperiosteal swelling of the anterior wall, which accounts for the shadow when the sinus is viewed from the front.

Schwartz [38] presents a branched transilluminator for simultaneous illumination of the two frontal sinuses or the antrums. This instrument was previously described by Merelli.[39]

Puff [40] apparently never heard of Hanson and other American authors, for his dissertation describes as his original discovery the presence of eosinophilia in the secretions of the nose as an indication of allergy.

Effler [41] gains considerable information as to the infective organism from the gross appearance of the "irrigate." In all cases of acute

37. Delobel, P.: L'ostéopériostite du maxillaire supérieur, cause d'erreur dans la diaphonoscopie et la radiographie, Echo méd. du Nord **5**:273 (Feb. 16) 1936.

38. Schwartz, L. H.: A Transilluminator for the Eyes and the Accessory Nasal Sinuses, Arch. Otolaryng. **23**:593 (May) 1936.

39. Merelli, G.: Contributo allo studio ed alla applicazione della diafanoscopia dei seni frontali, Ann. di laring., otol. **34**:99, 1935.

40. Puff, F.: Ueber die Aetiologie der polypösen Nasennebenhöhlen-erkrankungen, Dissert., Köln, 1935.

41. Effler, L. R.: The Diagnostic and Prognostic Value of Antrum-Irrigated Pus, Laryngoscope **46**:848 (Nov.) 1936.

involvement recovery is predicted by the appearance of solid clumps of mucoid masses in an otherwise clear solution. Staphylococcic infections produce a cloudy yellowish or white discharge, depending on whether the infection is caused by Staphylococcus aureus or Staphylococcus albus. The presence of Bacillus pyocyaneus is recognized by a greenish cast to the fluid. Bacillus proteus causes a foul odor. Streptococcic infections are usually associated with considerable fever, and the discharge is likely to be scanty, granular and blood tinged. Repeated irrigations are contraindicated until after the acute symptoms have subsided. In cases of chronic disease the author distinguishes two kinds of "irrigate." The simple is associated with stuffiness, intumescence and mucoid discharge. The "irrigate" contains flakes and shreds in a clear solution, and the patients require little local treatment, since they tend to get well under general treatment. The mixed type is of long standing and yields a milky "irrigate" of foul odor. It usually indicates the presence of polypi and degenerated mucosa and necessitates operation.

Lintz,[42] having tested 30 patients with chronic sinusitis, concludes that the sedimentation rate of the red blood cells is of no value in diagnosis, since he found only 2 cases in which the normal rate was exceeded.

Döderlein [43] describes a spring cannula screwed on the handle of the Lichwitz needle, which when released causes the needle to plunge forward 2 cm. He claims that this procedure is less terrifying to the patient than the use of the mallet, which is occasionally required when the bone is thick. He also states that he diagnoses the state of the mucosa of the antrum by passing a stiff wire through the needle, by means of which he palpates the tissues and determines the presence of polypi and the thickness of the membrane.

OCULAR COMPLICATIONS

Cordier, Coulouma and van Varseveld [44] review the history of orbito-ocular complications of sinus disease and after some general considerations discuss the subject under the following divisions: (1) the anatomic reasons for direct orbito-ocular complications of frank sinusitis, (2) the anatomic reasons for indirect complications, such as trophic disturbances, infectious lesions and thrombophlebitic lesions resulting from suppurative sinusitis, and (3) the anatomic basis for ocular neurogenic reflexes

42. Lintz, R. M.: The Red Blood Cell Sedimentation Rate in Chronic Sinusitis, Chronic Tonsillitis, and Dental Periapical Infections, J. Lab. & Clin. Med. **21**:1259 (Sept.) 1936.

43. Döderlein, W.: Zur diagnostischen und therapeutischen Technik bei Kieferhöhlenempyem, Ztschr. f. Laryng., Rhin., Otol. **26**:435, 1936.

44. Cordier, P.; Coulouma, P., and van Varseveld, F.: Quelques schémas sur les raisons anatomiques des complications orbito-oculaires d'origine naso-sinusienne, Echo méd. du Nord **5**:10 (Jan. 5); 47 (Jan. 12) 1936.

originating in the sinuses. Most of the work consists of plates and charts showing the relationship of the sinuses to the orbit and particularly the relationship of the sphenoid sinus and its prolongations to the ocular nerve, the trigeminal nerve, the sphenopalatine ganglion, etc. They classify orbital complications as direct or indirect and as to whether they arise from disease of the anterior or the posterior group of sinuses. Those arising from disease of the anterior group comprise the complications of the orbitomusculolacrimal area, such as phlegmon, dacryocystitis, functional paresis of the muscles and changes in the lids. Those arising from the posterior group mostly involve the nerves—optic neuritis, neuralgia of the sphenopalatine region and the trigeminal nerve and paresis of the third, fourth and sixth ocular nerves. The indirect complications may come from either suppurative or nonsuppurative sinusitis by way of cellular transmission, vascular routes, preformed channels and nerves. Through the cellular route there may develop an oculotrophic syndrome from compression of the ciliary ganglion by cellulitis or infection of the bulb from penetration of pus into the suprascleral space or the suprachoroid space at the level of the vasa vorticosa. Infection by the vascular route means retrograde thrombosis of veins communicating with the central vein of the retina or with the choroid veins. Dacryocystitis is an example of infection carried through a preformed channel. Transmission by way of the nerves is illustrated by irritation of the oculonasal sympathetic fibers of the middle turbinate being transmitted to the trigeminosympathetic fibers, causing reflex disturbances of the vessels of the eye, the angiovasomotor neuroses of Hyrtl.

Spaeth's [45] discussion is along the same lines. He points out the significant fact that one third of the venous drainage of the nasal mucosa passes upward into the ethmoid veins. He also cites a number of investigations as to the rôle of toxins. The incidence of infection of the uveal tract due to sinusitis is given by various authors as varying from 2 to 8 per cent. Infection of the ciliary body, thrombosis of the cavernous sinus, osteomyelitis and meningitis are mentioned as occasional complications. On the subject of optic neuritis the author leans to van der Hoeve's point of view, namely, that when the sinuses are clinically normal one must make a guarded prognosis. He also stresses the point that even in the presence of true sinusitis one must be on the lookout for other conditions that may be the cause of the neuritis, which should be sought out and treated.

Sargnon [46] contributes an article on orbital complications of sinusitis and like Cordier and his associates [44] makes a distinction between those

45. Spaeth, E. B.: The Ophthalmological Relationship to the Nasal Accessory Sinuses, Laryngoscope **46**:275 (April) 1936.

46. Sargnon, A.: Contribution à l'étude des fluxions orbitaires d'origine naso-sinusienne, Oto-rhino-laryng. internat. **19**:721 (Nov.) 1935.

involving the anterior, or palpebral, portion of the orbit and those of the posterior, or retro-orbital, portion. The former are benign and superficial, occurring in acute sinusitis from the fronto-ethmoid cells in the infant. They usually yield to palliative treatment but occasionally require external incision. The deep-seated infections are more serious. They are frequently associated with a markedly deviated septum or a large middle turbinate which blocks intranasal drainage. The author claims that infection of this type can be readily distinguished from orbitocavernous thrombophlebitis, since the latter is much more severe, more rapidly progressive and bilateral, with early cerebral symptoms. The diagnosis of orbital phlegmon is really difficult. In this condition more pain, a decline in vision with or without definite papillitis, mydriasis and corneal anesthesia are common. The bulb is fixed. Such symptoms are definite indications for surgical intervention. In cases in which the diagnosis is doubtful, it is well to make an exploratory puncture with a fine bistoury. The author advises that all persons with orbital infection be treated conservatively while one watches for signs of corneal anesthesia and pupillary changes. If the orbital symptoms do not subside rapidly, he advises intranasal treatment to help drainage, such as removal of the anterior end of the middle turbinate. When the posterior sinuses are at fault, the posterior end of the middle turbinate should be removed.

Flachs [47] reports several interesting cases of ocular complication due to infection of the antrum. One patient had a bipartite antrum (sagittal partition) in which only the outer portion was infected, causing optic neuritis. In another case an abscess of the orbit was due to an infection of the antrum of dental origin. The author expresses the belief that in most of his cases of optic neuritis the infection was transmitted directly through the intervening bone. This was demonstrated by the pathologic findings. In several other cases the infection was shown to have been carried by the blood stream. The author is impressed with the necessity for surgical intervention in most of his cases.

The occurrence of orbital complications in 3 per cent of a series of cases of sinus infection observed at the University of Helsingfors over a period of ten years is reported by Snellman.[48] Most of these complications were due to disease of the ethmoid sinus, and 67 per cent occurred in patients under 20. The invading organisms most frequently observed were streptococci. Periostitis and subperiosteal abscess were the most frequent complications, and not a single case of orbital abscess or optic neuritis was observed. Conservative treatment was successful

47. Flachs, H.: Sur la participation de l'orbite dans les sinusites avec considération spéciale du sinus maxillaire, Folia ophth. orient. **2**:152 (April) 1936.

48. Snellman, I.: Nenan sivuontelo-tulehdusten yhteydessa esuntyrista orbitakomplikaatioista, Duodecim **52**:811, 1936.

in the cases of simple periostitis. The subperiosteal abscesses were naturally drained by incision, while the offending sinuses were opened either intranasally or extranasally. The mortality was 4.7 per cent.

Djacos [49] finds it difficult to differentiate between orbital and palpebral involvement, as described by some authors. He describes in detail a case of orbital cellulitis in a woman of 60, with pain, edema, exophthalmos and fixation, which yielded to local antiphlogistic measures. The patient returned a week later with the same condition in the other eye, which also recovered under palliative treatment. The author naturally was fortunate in observing his patient early, before suppuration had taken place and at a time when prompt intranasal drainage and local application of heat effected resolution.

Terrien's [50] article discusses differential diagnosis between orbital cellulitis, phlegmon and thrombophlebitis but contributes nothing new.

Burger [51] reviews a series of 38 cases of orbital infection observed in fourteen years; 35 patients recovered, and 3 died, 2 with meningitis and 1 with abscess of the brain. He is strongly impressed with the tendency to spontaneous cure in young children before suppuration has taken place. Since in the vast majority of cases the infection occurs as a result of acute infection or acute exacerbation of a chronic infection, he finds it important to determine whether there is direct involvement of the orbital walls or secondary retrobulbar cellulitis. In his experience most infections pass from the sinuses to the periorbita by way of preformed channels. In fatal cases the difficulty has been that the intracranial symptoms were obscure, so that the process had advanced too far before the danger was recognized.

Halphen and Coussieu [52] report a case of orbital cellulitis in which nasal examination and roentgenograms revealed only an infection of the maxillary sinus. The antrum was opened, disclosing pus and a thickened membrane. The edema and swelling disappeared, but the vision remained poor. The author therefore proceeded to open the ethmoid and sphenoid sinuses but found no pathologic changes. Nevertheless, the vision improved. He poses the question as to whether the optic neuritis was due to toxemia or whether the restoration of vision was due solely to the local anesthesia, to the relief of stasis by the hemorrhage induced or to some undetermined cause.

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49. Djacos, M. C.: Un cas de fluction de l'orbite à bascule d'origine sinusienne, Bull. Soc. d'opht. de Paris, June 1936, p. 545.

50. Terrien, F.: Phlegmon orbitaire d'origine éthmoïdale et atrophie optique, Rev. gén. de clin. et de thérap. **50**:705 (Oct. 31) 1936.

51. Burger, H.: De behandeling der van de neusbijholten met ontstane, ontstekingen in de oogkas, Nederl. tijdschr. v. geneesk. **80**:1180 (March 21) 1936.

52. Halphen, E., and Coussieu, P.: Cellulite orbitaire consécutive à une sinusite maxillaire, Rev. d'oto-neuro-opht. **14**:198 (March) 1936.

In James' case [53] the outcome was not so fortunate. A man of 75, who had been operated on for chronic disease of the antrum a few years after a symptomless interval, suddenly complained of loss of vision in one eye. Examination revealed contraction of the visual field in the nasal quadrant and a large central scotoma. Roentgenograms showed definitely clouded posterior ethmoid and sphenoid sinuses, with a clearly defined fluid level. Intranasal operation disclosed pus. Although the operation was done five days from the onset and the suppuration was well cleaned out, the vision failed to return and atrophy of the optic nerve developed. The authors infer that the nerve was damaged by direct infection from the posterior sinuses at the apex of the orbit. Two months was required for the descending atrophy of the nerve to be established by examination of the fundus. They express the belief that it was fortunate that the infection did not spread backward to the cavernous sinus. "The line that divides two such possibilities must be an exceedingly fine one."

Koch and McCready [54] present a general survey of the subject with reference to conflicting theories as to direct or indirect causation. They advise careful inspection of the roentgenograms for slight cloudiness of the posterior sinuses, the result of impaired aeration. These may be the only indication of a hyperplastic state which may be the cause of optic neuritis.

Hecht [55] reports 17 cases of retrobulbar neuritis in which treatment was conservative, with good results in all but 1 case. He performed a resection of the middle turbinate and applied packs saturated with a solution of cocaine or of procaine hydrochloride and epinephrine for two hours twice daily. The treatment was carried out for periods of from two to six weeks. In cases in which there is definite evidence of a pathologic condition of the sinuses he recommends early surgical intervention.

Rainey [56] obtained a rapid cure in a case of blindness of both eyes, which developed rapidly in a man of 28. Within five days from the onset the patient could not even distinguish bright sunshine. The middle turbinates were infracted, and the posterior sinuses were opened. Nothing was found but a congested mucosa. Thirty-six hours later the

53. James, R. R.; Thomas, St. C.; Colledge, L., and Hodgson, H. G.: A Case of Acute Unilateral Retro-Bulbar Neuritis Associated with Nasal-Sinus Disease, Brit. J. Ophth. **20**:164 (March) 1936.

54. Koch, S. L., and McCready, J. H.: The Relationship Between Ethmoiditis and Ocular Disturbances, Am. J. Roentgenol. **35**:215 (Feb.) 1936.

55. Hecht, O.: Results of Conservative Therapy of Rhinogenic Retrobulbar Neuritis, Časop. lék. česk. **74**:1181 (Nov. 8) 1935.

56. Rainey, J. J.: Bilateral Blindness Due to Affection of the Posterior Accessory Sinuses, Laryngoscope **46**:185 (March) 1936.

patient could see the electric light in his room, and within forty-eight hours natural daylight was visible. The vision kept improving and returned to normal within two months.

Campbell [57] favors Benedict's theory that improvement following intranasal operation is due to improvement in the circulation of the nerve following the use of local anesthesia and also to the subsequent reaction, rise in temperature, congestion, etc., which may act in the same manner as the injection of a foreign protein. He advises early search for etiologic factors, such as diseased teeth, tonsils or sinuses. In the meantime one should enforce a rigid diet and hygiene plus local intranasal treatment with ephedrine and cocaine, saline solutions and tampons saturated with mild protein silver. Multiple sclerosis must always be kept in mind and ruled out if possible.

De Sanctis [58] feels that the Proetz displacement technic is capable of overcoming a block of the ostium of the sinus due either to a mucous plug or to inflamed tissue and that when it is successfully accomplished it will lead to improvement and possibly cure of secondary optic neuritis. He reports 3 cases with excellent accompanying roentgenograms to prove his point. In 2 of these the fluid failed to enter the sinus (sphenoid) at the first trial, but at the second test the procedure was successful and the condition was relieved.

In Persky's case [59] the optic neuritis developed suddenly and was accompanied by severe headache. There was a history of recurring headache with nasal discharge over a period of years, yet local examination failed to reveal any disease of the posterior sinuses. Operation revealed no pathologic condition except a large cell in the middle turbinate, removal of which was followed by gradual return of the vision.

Genet [60] expresses the belief that the term "retrobulbar neuritis" is a misnomer, since the condition is not true inflammation or neuritis. He considers the involvement in most cases to be due to a disturbance in the circulation of the nerve. He reports 2 cases in which the scotoma was variable, being both central and paracentral.

Worms [61] describes an interesting case of optic neuritis in a man of 21, which was complicated by a typical adiposogenital dystrophy.

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57. Campbell, E. H.: Relationship of Sinusitis to Optic and Retrobulbar Neuritis, Arch. Ophth. **16**:236 (Aug.) 1936.

58. de Sanctis, G. E.: Terapia alla Proetz in alcune forme di neurite retrobulbare da sinusite latente, Rev. oto-neuro-oftal. **13**:180 (March-April) 1936.

59. Persky, A. H.: Retrobulbar Neuritis of Sinus Origin, M. Rec. **144**:364 (Oct. 21) 1936.

60. Genet, L.: Les scotomes des névrites rétro-bulbaires, Bull. Soc. d'opht. de Paris, November 1935, pt. 2, p. 720.

61. Worms, M. G.: Névrite optique d'origine sphénoïdale, Bull. et mém. Soc. franç. d'opht. **48**:404, 1935.

Roentgenograms revealed enlargement of the sella, with partial destruction of the posterior clinoid processes. There was no polyuria or evidence of motor or sensory disturbances. Because of the rapid decline of the vision, trephination was advised, but permission was refused by the family. Radiotherapy was ineffective, and a general decline set in, resulting in death. Autopsy revealed inflammatory enlargement of the pituitary gland, perforation of the superior posterior wall of the sphenoid sinus and chronic infectious hyperplastic sphenoiditis. There had been nothing in the patient's history to suggest the involvement of the sinus, and the diagnosis was missed. Instead of a tumor of the hypophysis the condition proved to be inflammatory enlargement of the gland by extension of the infection from the sphenoid sinus through the necrosed wall to the optic nerves and the pituitary gland by way of the dura and the leptomeninges.

Durando [62] describes 5 cases of retrobulbar neuritis; 4 of the patients underwent operations on the sinuses, with relief. His explanation of the pathogenesis is based on the vascular connections between the vessels within the nerve sheath and those of the nose and the orbit. He suggests that special attention be paid to accommodative asthenopia as an important and frequently characteristic symptom of rhinogenic retrobulbar neuritis.

In Uyama's opinion [63] impaired vision from infection of the sinuses cannot always be attributed to one factor, but he is inclined to believe that direct extension of the inflammation and toxic irritation are the principal causes. In 2 of his cases the neuritis was due to infection of an antrum and cleared up promptly after radical surgical operation. In 2 other cases exophthalmos and double vision were due to combined disease of the ethmoid sinuses and the antrum and disappeared after palliative treatment and irrigation.

In Bonnet's case [64] a diagnosis of hematoma or mucocele was made for a boy of 15, who five months previously sustained a blow over the brow, which resulted in a painful orbital tumefaction with exophthalmos. Operation revealed nothing but several enormously dilated posterior ethmoid cells, the orbital walls of which were intact. No fluid was discovered. The exophthalmos receded, but the vision remained unchanged.

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62. Durando, F.: Neuriti ottiche retrobulbari da sinusite ed astenopia accomodativa, Riv. oto-neuro-oftal. **12**:675 (Sept.-Oct.) 1935.

63. Uyama, Y.: Ueber die Augenkomplikationen bei Nasennebenhöhlenerkrankungen, Ausz. z. Otol. (Tokyo) **40**:45, 1936.

64. Bonnet, P.: Exopthalmie par pneumo-sinus dilatant de l'ethmoïde, Bull. Soc. d'opht. de Paris, February 1936, p. 109.

Ninger [65] reports a case of periodically recurring exophthalmos due to empyema of the ethmoid sinuses, which was similar to that described by Everbuch, whom he quotes. He expresses the belief that the condition is due to circulatory stasis with secondary edema.

Inflammatory exophthalmos was found by Cohen [66] in 22 patients of a total of 1,517 with sinusitis examined at the Manhattan Eye and Ear Infirmary during a period of three years. The patients with acute and subacute involvement were treated conservatively unless there was evidence of suppuration. Those with chronic inflammation were more difficult to treat, since operation on the orbit failed to reveal any macroscopic cause for the exophthalmos. However, sections of tissue removed for histologic examination showed active diffuse infiltration with round cells. "A low grade osteitis or periostitis may accompany the sinus infection in these cases." The Krönlein operation was successfully performed in two cases. This procedure relieves the pressure, much as trephination of the skull relieves the pressure in cases of tumor of the brain. The case histories presented and the discussion of the pathogenesis and diagnosis are interesting.

Szolnoky [67] makes a distinction between exophthalmos due to orbital stenosis and that due to orbital plerosis. In the former the orbit becomes too small for the normal contents because of swelling of its walls, and in the latter the contents of the orbit are themselves increased. In the first type the condition may arise from such causes as mucocele or empyema of the sinuses, especially the frontal, and also in certain cases from a benign tumor, such as adenoma, fibroma, chondroma, osteoma and cholesteatoma. A malignant tumor, however, may break through the orbital walls and by direct invasion cause an increase in the orbital bulk resulting in exophthalmos of the second type.

Frost [68] reviews the literature on the subject of papilledema and finds a considerable diversity of opinion. He expresses the belief that papilledema associated with disease of the sinuses may be explained purely on a mechanical basis, since there may be pressure on the optic nerve without evidence of optic neuritis in the strict sense. He reports 2 cases in which symptoms of failing vision associated with dull pains about the eyes disclosed central scotoma and enlargement of the blind-spot. Although nasal examination failed to demonstrate positive evidence

65. Ninger, F.: Exophthalmos in Chronic Ethmoiditis, Časop. lék. česk. **75**:947 (July 24) 1936.

66. Cohen, M.: Inflammatory Exophthalmos in Catarrhal Disorders of the Accessory Sinuses, Arch. Ophth. **15**:457 (March) 1936.

67. Szolnoky, Z.: Die Nasennebenhöhlen Beziehungen des Exophthalmos, Orvosképzes **25**:211, 1935; abstr., Zentralbl. f. Hals-, Nasen- u. Ohrenh. **26**:434, 1936.

68. Frost, A. D.: Papilledema, with Special Reference to Papilledema Associated with Sinus Disease, Tr. Am. Ophth. Soc. **33**:480, 1935.

of disease of the sinuses, it was noted that the use of shrinking agents was followed by temporary improvement of the ocular symptoms. Operation disclosed hyperplastic mucosa in the posterior sinuses but no pus or polypi. Both patients recovered, and subsequent instillation of contrast mediums in 1 case showed the sphenoid sinus bordering closely on the optic foramen. The author is convinced that in his cases the papilledema was due entirely to mechanical pressure of inflamed tissues.

Franceschetti [69] describes in detail a case of chronic dacryocystitis of many years' duration, with an external fistula which had been unsuccessfully operated on on three occasions. Roentgenograms and lavage of the maxillary sinuses gave no evidence of disease. An extensive excision of the fistula through a wide exposure revealed a direct connection with the antrum. A Caldwell-Luc operation was then done, which exposed a sequestrum and masses of granulation tissue. The author claims to have found only 2 other cases of involvement of this character described in the literature. In the discussion which followed the presentation, van der Straeten stated that lacrimal fistulas due to involvement of the bony walls are not at all uncommon and explain many of the failures following extirpation of the sac. Raverdino called attention to a small duct, discovered by the Spanish otologist Filo and confirmed by Pietrantino, which runs from the "fossette ovale," uniting the maxillary sinus with the anterior ethmoid cells, that is to say the "periungeal cells." This can readily be demonstrated by injecting iodized poppy-seed oil and is the channel by which infection may be carried from the maxillary and ethmoid sinuses to the lacrimal area. Removal of the agger cells is necessary to cure the lacrimal disease.

INTRACRANIAL COMPLICATIONS

Courville [70] reported 2 fatal cases of extensive subdural abscess of the frontal lobe in which the frontal sinusitis was not diagnosed during life. Autopsy in both instances revealed extensive suppuration in these as well as in other sinuses, with necrosis of the posterior plate and the extradural and subdural abscess. The author points to the presence of contralateral jacksonian seizures (associated with aphasia in 1 case) as significant of a subdural abscess which is extending rapidly and causing cortical pressure. This symptom is of inestimable value, and when no other cause is apparent the sinuses should be thoroughly investigated. A history of previous infection of the respiratory tract or chronic nasal trouble can nearly always be elicited.

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69. Franceschetti, M. A.: Dacryocystite chronique consécutive à une sinusite maxillaire, Bull. et mém. Soc. franç. d'opht. **48**:27, 1935.

70. Courville, C. B.: Rhinogenous Subdural Abscess, Bull. Los Angeles Neurol. Soc. **1**:55 (June) 1936.

Cases of abscess of the brain were reported by Watson-Williams,[71] Hoge,[72] Piquet and Decoulx,[73] Arauz and Dodds[74] and Cavenagh.[75]

Watson-Williams' patient was a boy of 8 years who had bilateral maxillary sinusitis and otitis media. The abscess of the brain was shown to have arisen from the infection of the ear rather than from the sinusitis, although the latter probably antedated the former.

In both Hoge's cases the abscess followed infection due to swimming. The first patient showed symptoms within a few days: early suppuration of the sinus, necrosis of both plates and extradural and subdural abscess, resulting fatally. In the second case the abscess developed more slowly. Although symptoms of infection were present from the start, the patient was not admitted to the hospital for treament until one month had elapsed. She also had extensive involvement of the bone, extradural abscess and later an abscess of the frontal lobe, which was successfully drained. She recovered. These cases demonstrate that the patient's chances for recovery are in direct proportion to the length of time it takes for the process to develop. The early fulminating infections are always fatal.

The case reported by Piquet and Decoulx emphasizes a point that many others have learned through bitter experience, namely, that the successful evacuation of an abscess of the frontal lobe does not necessarily mean that one's troubles are over. There may be another abscess present, which is often overlooked and which sooner or later ruptures into the ventricle, with fatal outcome. In their case the second abscess was located in the opposite frontal lobe and communicated with the original abscess cavity by means of a fistula passing directly through the corpus callosum. There was a third abscess directly behind the second, which communicated with the ventricle and was the immediate cause of death. The authors point out the total inadequacy of symptoms and findings to diagnose the secondary abscesses. They state that the dangers of filling with iodized poppy-seed oil and ventriculography are too great to make such procedures feasible. They admit that their drainage was insufficient, although pressure symptoms were relieved through drainage of the opposite abscess by way of the corpus callosum into

71. Watson-Williams, E.: Brain Abscess Following Acute Otitis Media in a Child with Chronic Nasal Sinus Disease and Acute Nephritis: Operation; Secondary Encephalitis; Recovery, Brit. M. J. **2**:1152 (Dec. 14) 1935.

72. Hoge, T. R.: Some Severe Complications of Paranasal Sinusitis, West Virginia M. J. **32**:564 (Dec.) 1936.

73. Piquet, J., and Decoulx, P.: Abcès cérébral bilatéral consécutif à une sinusite frontale, Ann. d'oto-laryng., February 1936, p. 185.

74. Arauz, S. L., and Dodds, A.: Absceso cerebral frontal izquierdo riñogeno, Rev. Asoc. méd. argent. **49**:1827 (Nov.) 1935.

75. Cavenagh, J. B.: Case of Frontal Lobe Abscess Complicating Frontal Sinus Infection, J. Laryng. & Otol. **51**:239 (April) 1936.

the original abscess. However, it was certainly not diagnosed; neither was the isolated abscess which finally ruptured into the ventricle.

Arauz and Dodds were fortunate in having to deal with a slowly developing abscess, of which the only symptoms were persisting headache and a gradual lowering of the pulse rate. There were no focal or psychic symptoms. The abscess was drained by a glass tube left in place for twenty-six days until all secretion had ceased. The tube was then replaced with gauze saturated with bismuth tribromphenate, which was renewed frequently until the cavity was obliterated.

Cavenagh's case demonstrates the futility of halfway measures in cases of extensive pathologic involvement. Because of an infection, with severe headache and swelling of the upper eyelid, the ethmoid sinuses were first operated on intranasally. The swelling and ptosis increased. Roentgenograms showed cloudiness of all the sinuses. A second operation consisted of enlargement of the nasofrontal duct. The discharge increased as the headache lessened. But this was only temporary. The headache recurred in two weeks with increased severity and was accompanied by vomiting. A third operation was done, by the Howarth technic. The dura was exposed and was found covered with granulations. However, it was not opened. Papilledema soon ensued, accompanied by slowing of the pulse and reduction of temperature. At the fourth operation the dura was opened, the brain probed and an abscess located and drained. Headache soon reappeared. A fifth operation was performed; the exposure was enlarged, and the dura was incised crucially. More pus was evacuated from the brain. Herniation developed in the course of the after-treatment, and the patient recovered.

Meningitis resulting from disease of the sinuses is discussed by Smith,[76] Field and Rogers,[77] Jacobsgaard [78] and Kramer and Som.[79]

Smith comes forward with a new and rather startling proposal to drain the basal cisterna by way of a transpalatal and transsphenoid approach on the theory that infection spreading to the meninges is frequently held in check temporarily in the cisterna before extending to the rest of the meningeal spaces. He reports 2 cases in which the infection was thus treated. One patient was a woman of 33 with chronic pansinusitis for which operation had been done several times. An acute exacerbation was complicated by symptoms of meningeal disease, and

76. Smith, F.: Basal Meningitis, J. A. M. A. **107**:189 (July 18) 1936.

77. Field, C. E., and Rogers, H.: A Fatal Case of Meningitis Due to Infection of the Sphenoidal Sinus by Pfeiffer's Bacillus, Bristol Med.-Chir. J. **53**:151, 1936.

78. Jacobsgaard, J.: Pathologisch-anatomische Beiträge zur Frage nach den Fortleitungswegen der rhinogenen Meningitis, Ztschr. f. Laryng., Rhin., Otol. **26**:387, 1936.

79. Kramer, R., and Som, M. L.: Sphenoiditis with Meningitic Symptoms, Laryngoscope **46**:507 (July) 1936.

roentgenograms showed involvement of the sphenoid sinus, the basilar process and the articular surface of the occipital bone. Smith operated by way of the nose on account of the previous operations and the necessity for removing the diseased portion of the sphenoid bone. Small drills penetrated the floor and the posterior wall of the sphenoid sinus until the dura was reached. The drill was directed toward the middle third of the pons. The dura was opened, and a small rubber tube was inserted. The act of opening the dura and the consequent loss of fluid caused a marked disturbance in the pulse and respiration. The patient recovered, although for forty-eight hours she suffered severe headache, nausea and occipital pain. The author believes that this method of drainage is ideal in all cases of infection arising from infection of the sphenoid or the tip of the petrous pyramid.

Field and Rogers report a case of meningitis in a child of 4 years in which the bacteria recovered were proved morphologically and serologically to be Pfeiffer's bacillus. The patient lived seventeen days, and at autopsy suppurative sphenoiditis was uncovered. The authors found in searching the literature that some 300 cases of meningitis due to organisms resembling the Pfeiffer bacillus are on record, in 46 of which recovery occurred. These cases were sporadic and not associated with epidemics of influenza. A review of the cases in which recovery occurred showed that the treatment generally followed consisted of repeated lumbar puncture alone or combined with antimeningococcus serum given both intravenously and intraspinally. Anti-influenzal serum was successfully employed in 2 cases.

Jacobsgaard's work is important because it is based on histologic examination of the tissues from persons who died of meningitis following acute nasal conditions for which no surgical operation had been performed. He is thus able to demonstrate the pathways of infection unbroken by trauma. The results of his study revealed that the lymphatic sheaths of the olfactory nerve fibers and localized areas of osteomyelitis in the sinuses adjacent to the dura offer the most definite evidence of infection being transmitted to the meninges. In 2 cases of epidemic meningitis the nerve sheaths were definitely shown to be the direct means of transmitting the infection from the nose. The author points out that leukocytic infiltration of nerve sheaths may also occur by retrograde extension from meningitis due to other causes. It may, however, be differentiated from the ascending infection by the fact that the infiltration proceeds only as far as the perforations in the lamina cribrosa, where as in ascending infections the process may be traced from the nasal cavity upward through the cribriform openings. This work of Jacobsgaard is of great value because there has always existed considerable difference of opinion as to the relative importance of the venous channels and of the nerve fibers and their sheaths in the spread

of infection and most of the previous histologic reports have been based on autopsy specimens which were marred by operative trauma. The article is extensive and thorough and is well worth studying.

Meningitis due to infection of the sphenoid sinuses is the subject of a study by Kramer and Som, who report 10 cases, with 4 recoveries. One patient recovered through localization which favored surgical treatment, and 3 recovered spontaneously, possibly owing to the benign nature of the infecting organism or to some unexplained cause. The cardinal, almost pathognomonic, symptom found was pain in the occiput, often radiating to the temporal region and down the spine. It was present in 8 of the 10 cases and was always worse at night. Other meningeal symptoms succeeded the onset of headache. Rigidity of the neck was present at the first examination in all 10 cases, the Kernig sign in 5 and the Brudzinski sign in 3. Irrigation of the sphenoid sinus was the most dependable diagnostic test for infection of the sinus. If surgical intervention is not immediately imperative, the authors advise the instillation of iodized poppy-seed oil for roentgen studies. Lumbar puncture is necessary to rule out meningococcic infection, tuberculosis and subarachnoid hemorrhage. Poliomyelitis and encephalitis can be excluded by the neurologic examination. If otitis media is present, it may obscure the picture, and frequently the mastoid must be opened to exclude the otitic focus. When the diagnosis is established, the authors advise intranasal exenteration of the ethmoid and sphenoid sinuses, the mucosa of the sphenoid sinus being spared unless there are signs of osteomyelitis. In one case they removed the posterior wall of both sphenoid sinuses and exposed a cavity containing pus. All the cases in which bacteria were present in the spinal fluid were fatal. In the 4 cases in which recovery occurred, the cell count was never higher than 270. Consequently, one could hardly term these instances of true meningitis. They were undoubtedly the early stages of meningeal reaction to a spreading adjacent infection, which was halted by prompt treatment of the focus before the bacteria had passed to the meninges.

Goldman [80] studied the incidence of bacteremia in complications of infection of the sinuses. In a series of 300 cases of acute sinusitis observed at the Mount Sinai Hospital in New York between 1928 and 1936 there were 90 with complications; in 67 of these operation was performed. Cultures of the blood were taken in 37 and showed organisms in 16 (44 per cent). The author recommends routine culture of blood in all cases of acute infection of the sinuses as an aid in the diagnosis of impending complications. The presence of organisms in a culture of blood may be analogous in importance to similar findings

80. Goldman, J. L.: Complications of Acute Sinusitis with Special Reference to Bacteremias, Laryngoscope **46**:500 (July) 1936.

in acute otitis media. Of the 90 patients with complications, 35 died (39 per cent). These complications were mostly meningitis, thrombosis of the cavernous sinus, abscess of the brain or osteomyelitis. Orbital abscess or cellulitis was rarely fatal.

Spaeth's article [81] quotes statistics from the literature showing the comparative frequency or rarity of complications arising from the different sinuses. Five cases are reported to demonstrate the ocular symptoms that may be present in the course of various intracranial complications.

Jowett [82] does not find the incidence of sinusitis any greater among patients with mental disease than in the general population. He examined a series of 500 persons with mental disease and found 7.6 per cent to have infected sinuses. Of a control series of 184 normal persons 5 per cent had infected sinuses. These findings are at variance with those published by Pickworth and Graves, who claimed to have shown that sinusitis is a common cause of mental disease. The author objects to conclusions drawn from postmortem examination of the sinuses, since no comparable series has ever been published from subjects who had no mental disease. Even in the living the usual methods of diagnosis of disease of the sinuses, such as transillumination and roentgenograms, have been shown to be capable of error up to 19 per cent and 12 per cent, respectively, and 7.3 per cent when combined. The author relies on careful aspiration of material directly from the sinus, according to the method of Watson-Williams. He does not decry the work of enthusiasts in this field despite his negative findings. He concedes that an incidence of 10 per cent of sinusitis among the patients with mental disease in an institution merits investigation and thorough treatment.

OSTEOMYELITIS

On the basis of histologic studies in 3 recent cases, Mosher [83] is more convinced than ever of the necessity of wide excision of bone into areas known to be healthy to halt the spreading infection. He recommends the inverted T incision and removal of the frontal bone in one piece by a series of trephine openings through the entire thickness.

The only cases for which this technic is not recommended are those in which there is danger of rupturing the longitudinal sinus. In these the bony mass is divided close to the sinus, and then if necessary the

81. Spaeth, E. B.: The Ocular Manifestations of Rhinogenic and Otogenic Intracranial Complications, Laryngoscope **46**:323 (May) 1936.

82. Jowett, R. E.: Sinus Sepsis and Mental Disorder, J. Ment. Sc. **82**:28 (Jan.) 1936.

83. Mosher, H. P.: Osteomyelitis of the Frontal Bone, J. A. M. A. **107**:942 (Sept. 19) 1936.

remainder is gently separated from the underlying dura before being removed. Some points brought out by the author from a study of his cases are as follows: 1. Wide excision of bone facilitates the herniation of an abscess of the frontal lobe. In these cases he recommends removal of a "cone of brain tissue down to the abscess with the diathermy knife" as "an improvement over older procedures." 2. Pus welling up from the diploe through trephine openings indicates extradural abscess, although the latter may be present without the former. 3. Thrombosis of the longitudinal sinus is frequently overlooked. 4. Bacteriophage administered locally and intravenously is a helpful therapeutic agent. 5. Swimming seems to be an etiologic factor in many of the cases of severe involvement. 6. In 1 case the roentgenogram did not give positive evidence of necrosis of the bone until nine days after the frontal swelling had appeared. 7. It is important to examine the external angles of the sinuses, since the process may be progressing from there and be overlooked. 8. Histologic examination of the bone shows marrow spaces filled with lymphocytes and frequently small abscesses. Rupture takes place more frequently through the internal than through the external plate. 9. Edema of the soft parts is a fairly reliable guide to the extent of involvement of the bone. 10. Infection spreads both by way of the diploetic veins and along the inner surface of the bone. 11. Roentgenograms do not show involvement until necrosis of the bone has taken place, and this is not apparent until at least several days after the edema and pitting have appeared.

Podestá and Carrascosa [84] accomplished the cure of acute spreading osteomyelitis by means of the Riedel operation and wide excision of the frontal bone into healthy tissue. Subsequently, however, it was necessary to do an intranasal operation on the ethmoid bone to clean out a local suppurative focus. Still later a minor plastic operation was required to close the persisting external fistula.

Jones [85] is also in favor of radical surgical intervention and reports 4 cases in which the frontal bones were removed through the inverted T incision. He advises painting the dura with a 5 per cent solution of iodine and recommends primary suture of the soft tissues, leaving only a dependent gutta percha drain.

Chavany and Quenu [86] report a case in which osteomyelitis of the frontal bone was metastatic from anthrax of the buttock. It began

84. Podestá, R., and Carrascosa, A. E.: Sinusitis fronto-maxilar aguda. Osteitis circumscripta del hueso frontal. Operación de Riedel. Curación, Rev. Asoc. méd. argent. **49**:1817 (Nov.) 1935.

85. Jones, A. C.: Osteomyelitis of the Frontal Bone, Ann. Otol., Rhin. & Laryng. **45**:726 (Sept.) 1936.

86. Chavany, J. A., and Quenu, J.: Ostéomyélite aiguë de l'os frontal, Presse méd. **44**:845 (May 23) 1936.

one month after the primary lesion was opened and drained. Severe headache and what looked like a boil on the forehead were noted. Incision revealed an abscess, a large defect in the bone, pus in the diploe and an epidural abscess. The opening was enlarged to a diameter of 4 cm. into what looked like healthy bone. One month later epileptic attacks began to occur. They were taken to be evidence of involvement of motor areas, and a diagnosis of abscess of the frontal lobe was made. Roentgenograms showed diffuse osteomyelitis involving most of the cranial vault, which was confirmed at operation. Puncture of the brain yielded liquefied brain tissue. The case ended fatally. The authors admit the inadequacy of their early surgical treatment in this case and are convinced that early wide exposure and excision into healthy areas is imperative. They also failed to follow up the first operation with roentgen studies until symptoms of involvement of the brain appeared.

Lewis [87] reports an interesting case of a girl of 12 years, whose symptoms came on suddenly after bathing. There were chills, high fever and signs of meningeal disturbance. Smears and cultures of the spinal fluid yielded 100 cells, mostly polymorphonuclears and streptococci. She was treated by the intravenous injection of metaphen (1:1,000), and both frontal sinuses were opened and drained. Some osteomyelitis was shown in the roentgenograms, but it was treated conservatively because the condition was improving and several small sequestrums were being expelled. Six months later, after influenza, symptoms of involvement of the brain appeared. Operation on two occasions revealed abscesses in different parts of the frontal lobe, which yielded staphylococci on culture. The interesting points about this case were the different bacteria recovered from the spinal fluid in the initial meningitis (streptococci) and from the abscesses of the brain (staphylococci) and the low polymorphonuclear cell count in the presence of large amounts of pus. The author considers the possibility that the abscesses of the brain may have been due to a secondary infection by way of the external fistula and also poses questions as to possibility of recurrence of abscess of the brain and the effect of past suppuration on the patient's mentality.

Braun [88] describes a case of unilateral exophthalmos with displacement of the bulb downward and outward, in which the condition was diagnosed as a lacrimal tumor. Over a period of ten years several subperiosteal abscesses were opened in the region of the orbit, extending into

87. Lewis, H.: Report of a Case of Osteomyelitis of the Frontal Bone Followed by Multiple Frontal Lobe Abscesses, J. Laryng. & Otol. **51**:107 (Feb.) 1936.

88. Braun, R.: Senkungsabszesse in der Orbita bei Osteomyelitis tuberculosa mit Knochenneubildung in der Stirnhöhle, Ztschr. f. Augenh. **89**:257 (July) 1936.

the lids. Eventual radical operation revealed deposits of new bone in the medial position of the frontal sinus, histologic examination of which showed the condition to be osteomyelitis tuberculosa. The rest of the sinus revealed a tuberculous process, with perforation of the floor of the sinus into the orbit. An interesting photomicrograph of a section of the bone accompanies the article.

Clevenger [89] observed a case of osteomyelitis of the skull originating in the ethmoid bone. The patient, a woman of 24, first presented orbital cellulitis after an operation on the labyrinth of the ethmoid bone. Improvement followed for a short time, after which pain and fever recurred, with continued discharge. A septic condition ensued, lasting two months, when roentgenograms revealed osteomyelitis of the frontal bone. An external operation was performed, with removal of a sequestrum. The symptoms, however, persisted, with evidences of intracranial involvement. Autopsy revealed the osteomyelitic process involving the cranial floor and extending clear back to the mastoids. The cribriform plate and the perpendicular plate were involved in one large sequestrum.

Alonso [90] had a good result in the treatment of a child of 12 who acquired osteomyelitis as a complication of acute frontal sinusitis and was operated on by the Mosher technic. In addition, he used an autovaccine prepared from the staphylococci recovered from the secretion. The process was completely cured within six weeks.

Osteomyelitis of the upper jaw in infants is not an uncommon condition, and Tamura [91] reports 2 cases, one in a 41 day old infant and the other in a child of 15 months. The latter had an elevated temperature for seven months. Swelling appeared over the left side of the face and the eyelids, and exophthalmos was present. There was drainage of pus from the nose, and a fistula was found in the canine fossa. Operation consisted of an incision in the gingival recess, with removal of a sequestrum. Recovery followed. The 41 day old infant had fever for ten days, with the same symptoms as the other child plus swelling of the hard palate. It was operated on in the same way, with a good result.

Another case of osteomyelitis resulting from maxillary sinusitis is reported by Lennon.[92] In this instance the process spread from the

89. Clevenger, W. F.: Osteomyelitis of the Skull Originating in the Ethmoid Area, Tr. Indiana Acad. Ophth. & Otolaryng. **20**:59, 1936.

90. Alonso, J. M.: Ueber einen fall von osteomyelitis des Stirnbeins, An. de oto-rino-laring. d. Uruguay **5**:108, 1935.

91. Tamura, I.: Osteomyelitis des Oberkiefers beim Säugling, Oto-rhino-laryng. **9**:712 (Aug.) 1936.

92. Lennon, A. N.: Report of a Case of Maxillary Sinusitis with Complicating Spreading Osteomyelitis, Brain Abscess and Death, Laryngoscope **46**:754 (Oct.) 1936.

maxilla to the nasal bones, the frontal and the malar bone, eventually involving the orbit and the sphenoid bone. Several minor and two major operations failed to halt the process. Subdural, epidural and central abscesses finally caused death. The author reviews 91 cases of osteomyelitis of the frontal bone reported in the literature and finds the average age of the patients to be 25, the predominating organism Staph. aureus and the average interval between onset and the original operation ten days. He believes that the infection travels along the diploe and is far in advance of the roentgen findings. The mortality is higher in postoperative cases.

Decoulx, Patoir and Bedrine [93] report 2 fatal cases of extensive osteomyelitis of the skull following suppuration of the frontal sinus. They discuss the two schools of thought with reference to treatment —the conservative school (Luc, MacKenzie and others), who attribute the spread of infection to operative procedures which break down the natural barriers and tend to spread the infection by way of the vascular routes, and the radical school. They draw a comparison between the course of spontaneous osteomyelitis and that which succeeds surgical operation on the sinuses and advise delaying intervention beyond simple drainage as long as possible. They point out the danger attending curettement of the diseased area and advise careful removal of both the inner and the outer plate, avoiding trauma to the dura. They advocate wide-open drainage and supportive treatment by means of vaccine therapy, radiotherapy and general constitutional measures. Their general conclusion is that when surgical intervention is indicated it should be radical enough to insure reaching healthy tissue.

SINUSITIS IN CHILDREN

Leicher [94] confesses that the diagnosis of disease of the sinuses in children is often difficult. He claims that secretions from the nasal cavities proper accumulate in the middle meatus instead of gravitating to the inferior meatus, which is shallow in the young. This is further aggravated by large adenoids. He advises thorough shrinking, suction and inspection of the middle meatus for recurring secretion. When the inferior turbinate is swollen, he recommends the application of trichloracetic acid with a fine probe along a single line for the entire length of the turbinate. It induces fibrosis in about eight to ten days, which helps drainage. He also found short wave diathermy and light therapy of value.

93. Decoulx, P.; Patoir, G., and Bedrine, H.: L'ostéomyélite diffuse envahissante des os du crâne, consécutive aux suppurations sinusiennes ou otiques, J. de chir. **47**:232 (Feb.) 1936.

94. Leicher, H.: Die Nebenhöhlenerkrankungen beim Kind, Med. Klin. **32**: 273 (Feb. 28) 1936.

Looper [95] also mentions the difficulty in diagnosis but favors the use of the nasopharyngoscope and exploratory puncture of the antrum. He feels that unrecognized sinusitis may lay the foundation for a chronic condition and retard the development of the sinuses. He suggests that all children about to have their tonsils and adenoids removed should be thoroughly examined for infection of the sinuses, since recognition and treatment of the process will avoid the failure and disappointment which frequently follow the operation.

Since his report in 1925 on the use of rubber tubes, Shea [96] has made the following changes: "More attention is paid to the patency of the natural ostium; the number of days which the tubes are allowed to remain in place has been reduced from five or six to three or four days; the irrigating solution has been changed to normal physiologic solution of sodium chloride, or the inflation of air is used." The size of the tube varies from 12 to 16 French. Emphasis is placed on maintaining the patency of the normal ostium, or if it is inaccessible he advises making an opening in the membranous wall of the middle meatus. The window in the antrum is made with a trocar in young children and with a curved gouge in older ones. The opening is shaped to fit the tube by the use of Ritter's dilators. The postoperative care consists in keeping the tube clear, oil being used to prevent blocking. After the tubes are removed, irrigations may be continued as long as necessary. The author recommends the use of autogenous vaccines made from secretions aspirated from the sinus and administered in three series of injections—one in the fall, one during the winter and one in the spring.

Laskiewicz [97] reports 18 cases of sinusitis in children of ages ranging from 8 months to 14 years, with complications in 8. In 6 the complication consisted of edema of the lids; in 1 the abscess ruptured into the orbit, and in 1 into the frontal area. He strongly favors the Proetz displacement irrigation as modified by Le Mée as routine treatment for all children.

Crebbin [98] recommends neo-silvol dropped in the nose "while the child is prone on his back" (a unique position if it can be achieved!). He has found neosynephrin satisfactory in chronic sinusitis and also has had good results from tampons saturated with a solution of

95. Looper, E. A.: Infection of the Para-Nasal Sinuses in Children, Bull. School Med. Univ. Maryland **20**:105 (Jan.) 1936.

96. Shea, J. J.: Fifteen Years' Experience with Drainage Tubes After Antrostomy in Children, Arch. Otolaryng. **24**:14 (July) 1936.

97. Laskiewicz, A.: Nebenhöhlenentzündungen bei Kindern und ihre Komplikationen, Polski przegl. otol. **10**:179, 1935.

98. Crebbin, J. T.: Sinus Disease in Children, Tri-State M. J. **8**:1589 (Feb.) 1936.

neosilvol (40 per cent) applied for fifteen minute periods. If necessary, the antrum may be punctured with a trocar and irrigated with a saline solution followed by the instillation of a 20 per cent solution of neosilvol.

Gundrum [99] has had good results in chronic sinusitis from the use of displacement irrigation. Shrinkage is accomplished with a 0.5 per cent solution of ephedrine and is followed by a 0.5 per cent solution of phenol in light liquid petrolatum. He also recommends stock vaccines, which in his hands have proved as effective as the autogenous vaccines. Another method of treatment which has proved successful is the combined use of neosynephrin hydrochloride with the antigen applied locally. He begins with a 10 per cent solution of bacterial antigen in a 0.125 per cent solution of neosynephrin hydrochloride in a saline solution and increases the concentration of the antigen gradually up to a maximum of as high as 100 per cent. Thirty-seven patients were treated in this manner, 36 of whom had previously had their tonsils and adenoids removed, and 32 of them were markedly improved.

Lumsden [100] reports 6 cases of orbital infection, in 4 of which the infection was due to disease of the frontal sinusis and in 2 to disease of the ethmoid sinuses; in 3 of the 6 the antrum was likewise affected. In 3 of the cases of involvement of the frontal sinus the lesion was opened externally and drained. He points to the value of roentgenograms in determining the presence of disease of a frontal sinus, although the degree of infection cannot always be accurately determined.

Schönberg [101] studied autopsy reports on 232 new-born infants and found that in a large proportion (31 per cent) the cause of death was an exogenic nutritional disturbance. In 75 per cent of these cases a definite infection of the sinuses was present. Pneumonia accounted for 17 per cent of the deaths, and in most cases coexistent parenchymatous inflammation of the liver was present. The author traces the course of the process in most cases as follows: In the beginning there is mild rhinitis, which soon involves the sinuses and frequently the middle ear. The condition is not acute, and there is little elevation of temperature. Low grade sepsis develops, which involves the liver and presents symptoms of digestive disorder, with consequent loss of nutrition. The author believes that mild colds in infants should be treated with the greatest care and should be regarded more seriously than they frequently are. The period from the second to the sixth month seems to be the most

99. Gundrum, L. K.: Sinusitis in Children: Treatment with Bacterial Antigens, Arch. Pediat. **53**:287 (May) 1936.

100. Lumsden, R. B.: Six Cases of Orbital Infection of Nasal Origin, Occurring in Children, J. Laryng. & Otol. **51**:230 (April) 1936.

101. Schönberg, H.: Zur Frage der Nebenhöhlenaffektion beim Säugling, Arch. f. Kinderh. **107**:216, 1936.

dangerous. Local treatment is often difficult, but the author finds short wave therapy efficient. Involvement of the liver calls for intensive dextrose therapy.

Iwata [102] reports 2 cases of sinusitis due to scarlet fever. In 1 patient (a boy of 13) there was swelling of the lids and the root of the nose, with tenderness over the cheek. Drainage from the nose was spontaneous, and recovery followed. In the other, a child of 21 months, with scarlet fever and diphtheria, a diagnosis of acute maxillary sinusitis was made after some delay, and the operation was fruitless. Death was due to asphyxia from extensive edema and phlegmonous swelling extending from the cheek to the neck.

SINUSES IN RELATION TO OTHER ORGANS

Kelley [103] studied 100 cases of asthma. On the basis of roentgen findings sinusitis was diagnosed in 89. The antrums were involved in 82, the ethmoid sinuses in 69, the sphenoid sinuses in 66 and the frontal sinuses in 46. Washings from the antrums in most cases revealed a clear fluid or one containing "small globular masses of mucopus." Frequently large masses of mucopurulent material were found, but frank pus was rare. When there were definite allergic reactions, the sinuses yielded a larger content of mucus in the washings than was obtained in simple hyperplastic disease.

De Stio [104] reports 13 cases of asthma in which the patient was operated on by the external route, with only 3 cures (23 per cent). Several patients were improved, but 54 per cent showed absolutely no change. Definite pathologic involvement was found in all the cases. The author attributes his poor results to the underlying allergic factor and to the fact that operation was undertaken after too long a delay. Many of the patients had been previously subjected to one or more intranasal operations. The author believes that chronic hyperplastic sinusitis is not the cause of asthma but that both conditions are probably "the result of the patient's allergic nature."

Harbert [105] finds that the wide difference in the reports of various authors on the subject of sinusitis and asthma is due to "absence of controls in reporting series of cases, differences in criteria of diagnosis

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102. Iwata, I.: Sinusitis maxillaris acuta scarlatinosa, Oto-rhino-laryng. **9**:319 (April) 1936.

103. Kelley, S. F.: The Incidence of Sinusitis and Nasal Polypi in Bronchial Asthma, Laryngoscope **46**:692 (Sept.) 1936.

104. De Stio, D. S.: The Pansinus Operation for Asthma, Arch. Otolaryng. **24**:606 (Nov.) 1936.

105. Harbert, F.: A Review of the Relation Between Sinusitis and Pulmonary Disease, U. S. Nav. M. Bull. **34**:52 (Jan.) 1936.

and standards of cures, generalization from too few cases, observation over too limited a period of time and failure to properly evaluate other factors such as allergy, etc." He cites one instance in which an author was quoted as stating that 85 per cent of a series of asthmatic persons showed roentgen evidence of sinus disease and in which the author making the quotation failed to mention that in 78 per cent of a control series of 50 supposedly normal persons sinus disease was also noted. He points to the fact that a sinus may appear cloudy on the roentgenograms long after all clinical symptoms have disappeared. "Since there is a catarrhal sinusitis with every cold it is not surprising to find a high incidence of slight persistent changes in the sinus mucosa." He also quotes other authors to show that asthmatic persons relieved for months after a Caldwell-Luc operation later have a recurrence of their symptoms. Therefore, longer observation is necessary. The author feels that the underlying allergic state must be run down and the patient desensitized. Sinusitis may be present but should be treated as in nonasthmatic persons until the allergic state is cured. He favors conservative treatment with removal of polyps if they are present and refers to the French school, who seem to have accomplished good results by this procedure. He believes, however, that in children with chronic cough, especially following influenza, quicker results may be obtained through surgical intervention, and he refers to Knight's series of 190 patients with chronic bronchitis, all of whom had sinusitis and 164 of whom recovered after some surgical procedure.

Watkins [106] claims that bronchiectasis is frequently prevented by timely diagnosis and treatment of a sinus condition in the presence of a chronic intractable cough. He reports 56 cases of bronchiectasis from the Newcastle General Hospital in 89 per cent of which there was evidence of sinus disease. The antrums were involved in every case; in 38 per cent alone and in 63 per cent along with other sinuses. He says that in Australia "it is quite the exception to find bronchiectasis (especially in children) without sinusitis," and he believes that the infection is carried by direct aspiration rather than by way of the lymphatics.

Hodge's article [107] is a summary of a paper read at a joint meeting of the Canadian Medical Association and the American Medical Association in Atlantic City, N. J., on June 13, 1935.[108]

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106. Watkins, A. B. K.: Oto-Rhino-Laryngological Considerations in Bronchiectasis, M. J. Australia **2**:118 (July 25) 1936.

107. Hodge, G. E.: The Relation of Bronchiectasis to Paranasal Sinus Infection, Canad. M. A. J. **34**:666 (June) 1936.

108. Hodge, G. E.: The Relation of Bronchiectasis to Infection of Paranasal Sinuses, Arch. Otolaryng. **22**:537 (Nov.) 1935.

Léon-Kindberg and Blinder[109] report an interesting case of a man of 37, previously healthy, who, after acute rhinitis, acquired a maxillary sinusitis, with free discharge of pus. The sinus was opened and drained, but the condition continued unabated. Since he acquired fever, cough and cyanosis, roentgenograms were made, and they showed numerous areas of consolidation in the right lung. It looked like confluent bronchopneumonia. The process progressed, and successive pictures showed the development of a pulmonary abscess. Numerous smears were negative for the tubercle bacillus. He was treated by bronchoscopic aspiration, and the abscess was cleaned out, but later pictures showed hilar and perihilar density, with areas revealing loss of substance. At this time the laboratory reports stated that tubercle bacilli were found in the secretions. The general condition became worse, and the patient died from repeated hemorrhages and inanition. The author feels that the pulmonary infection must have activated an old healed tuberculous focus and the succession of clinical phenomena was a rare one seldom described.

Littell[110] finds a definite relation between arthritis and disease of the sinuses and has had only 2 serious disappointments in 20 cases observed recently. In the rest of the group there was improvement up to 100 per cent. The diagnosis of chronic disease of the ethmoid sinuses was made by repeated nasal examination showing swelling of the mucosa and stuffiness, with frequent blockage due to high deviation. The history in these cases frequently reveals that the onset of the rheumatism was coincident with acute infection of the respiratory tract. Treatment usually consisted of resection of the septum when necessary and exenteration of the ethmoid sinuses. The roentgenograms as a rule were not of much help in the diagnosis.

Schwarze[111] cites the statements of many authors to show that grip alone does not cause secondary infection in the central nervous system but acts only as the precipitating factor for the filtrable virus which enters through the tissues of the nose and throat. He explains the frequency of poliomyelitis in children by the anatomic conditions which facilitate the spread of infection from the underdeveloped structures of the nose and sinuses to the cranial cavity. In over 50 per cent of

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109. Léon-Kindberg, M., and Blinder, H.: Tuberculose consécutive à une suppuration pulmonaire, Bull. et mém. Soc. méd. d. hôp. de Paris **52**:160 (Feb. 10) 1936.

110. Littell, J. J.: The Relation of Sinusitis to Arthritis, J. Indiana M. A. **29**: 270 (June) 1936.

111. Schwarze: Zusammenhänge zwischen Erkrankungen des Nasengebiets und den Virus-Erkrankungen des Centralnervensystems, Ztschr. f. Laryng., Rhin., Otol. **26**:305, 1935.

autopsies on patients with poliomyelitis extensive pathologic involvement has been found in the nose and nasopharynx. The author emphasizes the need for thorough disinfection of the nose and throat in every attack of simple acute rhinitis in children. He speaks highly of a preparation of quinine and antipyrine, which disinfects without irritating the tissues. The author discusses optic neuritis and claims that statistics show that in 60 per cent of the cases multiple sclerosis is accompanied by a form of optic neuritis which can be clearly differentiated from that due to other causes. Some writers claim that optic neuritis also occurs in a high percentage of cases of grip, and the author deduces that there is a specific neurotropic virus which causes multiple sclerosis and that grip acts as the excitant. The optic neuritis in these cases is characteristic; it is unilateral and appears early, being frequently the first symptom of multiple sclerosis. The author concludes, therefore, that it is imperative to open the ethmoid and sphenoid sinuses when optic neuritis develops after an attack of grip.

Widespread encephalitis during the epidemic of grip in 1918 led to the theory that a neurotropic virus gains entrance through the nasal tissues. The author calls attention to the rôle of the nasal tissues in the vital regulatory apparatus of the vegetative nervous system and is convinced that disturbances in this region may lay the foundation for the entry to the central nervous system of a virus, which may lie dormant for long periods. He concludes, therefore, that the several examples cited prove the importance of the sinuses as portals of infection to the brain, especially when they have been damaged by an attack of grip.

NONMALIGNANT TUMOR

Klykova [112] declares that mucocele is a comparatively rare condition, having been observed in only 3 of a total number of 393,438 patients admitted to the dispensary of the Moscow Eye Hospital. He reports 1 case in which the condition was due to trauma sustained some time previously. He mentions differentiation from meningocele by the fact that the size of a mucocele does not change with alteration of the position of the head or on compression. He also considers the presence of a palpable bony projection of the upper edge of the orbit a particularly valuable sign in the diagnosis.

Collet and Charachon [113] report the occurrence of a mucocele the size of a hen's egg in a frontal sinus of a man of 73. Despite the large

112. Klykova, A. L.: Mucocele of the Frontal-Ethmoidal Sinus, Sovet. vestnik oftal. **8**:859, 1936.

113. Collet, F. J., and Charachon, J.: Fausse tumeur de l'orbite, mucocèle suppurée, Lyon méd. **158**:145 (Aug. 9) 1936.

size of the tumor, there was no erosion of the posterior sinus wall, although the orbital wall was destroyed. The growth was diagnosed at first as an orbital tumor.

Sédan's case [114] was interesting because of the fact that the patient complained of intermittent attacks of diplopia over a period of fifteen months before there were any external evidences of the growth. He attributes the symptom to low grade periostitis affecting the superior oblique muscle. Later, the tumor developed to such a size as to displace the bulb 20 mm. externally and 6 mm. downward. The orbit was eroded, and at operation the posterior wall of the tumor was found in contact with the dura.

In Bayer's [115] case the tumor developed seven years after acute frontal sinusitis and at operation was found to have invaded the frontal, ethmoid and sphenoid sinuses, destroying all intercellular partitions.

Malan [116] believes in the theory that the genesis of mucocele is chiefly blockage of the nasofrontal duct, which may be partly congenital and partly due to trauma or disease. Both cases observed by the author occurred in women. The course depends on the state of the duct. In 1 case the tumor developed in three months to large proportions, and in other cases, in which intermittent nasal discharge was present, the growth has gone on for as long as fifty-two years.

Giuffrida and Tristaino [117] report a case in which the patient was operated on successfully by the intranasal route. They speak for the rationality of using this in preference to the external route because it is important to obtain a large opening for intranasal drainage. However, they add the statement that when this method fails the external operation may be necessary.

Laskiewicz [118] goes to some length in discussing the pathogenesis and histology of mucocele. He found the interior of the cyst lined with a thin glistening pale membrane, which contained no glands and was covered with many layers of cylindric cell epithelium. The external surface of the cyst was covered with thick mucosa containing many dilated blood vessels and numerous glands. For the most part, the outermost layer consisted of cylindric cell ciliated epithelium. In some instances this epithelium had undergone metaplasia into squamous cells.

114. Sédan, J.: Dipopie intermittente préludant à l'envahissement orbitaire d'une mucocèle frontale, Rev. d'oto-neuro-opht. **14**:561 (Sept.-Oct.) 1936.

115. Bayer, L.: Eine grosse, nach aussen durchgewachsene Mukozele der Stirnhöhle, Röntgenpraxis **8**:610 (Sept.) 1936.

116. Malan, A.: Del mucocele dei seni paranasali, Atti clin. otol. **2**:98, 1935.

117. Giuffrida, E., and Tristaino, L.: Su di un caso di mucocele etmoidale con speciale riguardo al suo trattamento chirurgico, Rev. oto-neuro-oftal. **13**: 244 (May-June) 1936.

118. Laskiewicz, A.: De la mucocèle ethmoïdale, Rev. de laryng. **57**:637 (June) 1936.

The absence of cavernous spaces in the outer coverings constitutes an argument against the Hajek theory that these cysts are formed by an infolding of the margins of the middle turbinate. On the contrary, the similarity of the structure of the inner lining to that of the lining of normal ethmoid cells leads the author to believe that ethmoid mucocele is due to congenital dilations of the anterior portion of the middle turbinate, which constitutes a prolongation of the ethmoid cells (or "cellulae conchae," according to Zuckerkandl). The author finds many evidences in the histologic picture of the bone and the periosteum indicating that inflammatory processes influence the development of these cysts. The accumulation of a large amount of fluid in the cyst causes ectasia of the congenital cavity, resulting in expansion in various directions, producing a mucocele. The author favors intranasal surgical intervention when the process is limited to the middle turbinate and the ethmoid cells proper. Even when the cyst is large enough to cause displacement of the bulb, he has seen a rapid return to the normal position after intranasal operation.

Bonnet [119] describes a large fronto-ethmoid mucocele the lower pole of which was separated from the nasal cavity proper only by the nasal mucosa. It was therefore easy to provide a large opening into the nose for drainage. The contents of the sac resembled bile.

In de Francesco's [120] case operation revealed a cavity that was bounded externally by the lamina papyracea and cranially by the posterior wall of the sphenoid. He claims to have found reports of only 6 cases of mucocele of the sphenoid sinuses.

Goto [121] reports a case of mucocele of the antrum in a man of 53, whose complaint was toothache followed by a swelling of the face and nasal block. There was no history of previous surgical operation. Exploratory puncture revealed yellowish brown fluid containing cholesterol. Operation resulted in so profuse a hemorrhage that the external carotid artery had to be ligated.

Fudita [122] observed a cystic tumor causing swelling of the cheek and nasal block which developed eight years after a radical operation on the antrum. It was removed through the mouth, and it measured 2.2 by 3.5 by 4.5 cm. and contained dark brown mucoid material. A second cystic mass was found in the roof of the antrum and proved to be a mucocele of the ethmoid sinus.

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119. Bonnet, P.: Mucocèle géante du sinus frontal, Bull. Soc. d'opht. de Paris, November 1935, pt. 2, p. 728.

120. de Francesco, Domenico: Nuovo caso di mucocele del seno sfenoidale, Oto-rino-laring. ital. **6**:42 (Jan.) 1936.

121. Goto, S.: Mucocele der Kieferhöhle, Oto-rhino-laryng. **9**:17 (Jan.) 1935.

122. Fudita, Y.: Ueber die postoperative Wangenzyste (Kubo) mit mucocele der Siebbeinzellen, Oto-rhino-laryng. **9**:219 (March) 1936.

Muta and Matsunaga [123] describe the case of a man of 36 who twelve years previously sustained a contusion of the nose. Three years before he was examined, a number of polypi were removed. Recently he complained of nasal block and a feeling of weight in the side of the head operated on. Examination disclosed a cystlike swelling of the inferior turbinate. Puncture revealed foul pus and diploccoci. Roentgenograms showed a cystic tumor of the antrum. Radical operation was performed, and a pyocele was removed, which the author believes was due in large measure to the old trauma.

Leicher [124] reports a case of mucoceles of each ethmoid sinus, one in the early state and the other advanced to excessive widening of the nasofrontal duct, a defect in the floor of the frontal sinus, displacement of the bulb and compression of the frontal lobe of the brain. The growth originated in an enlarged ethmoid bulla. Secondary infection caused a pyocele.

Tsuru [125] reports a case of vascular fibroma of the antrum in a woman of 33. The symptoms developed in four months and consisted of nasal block, repeated hemorrhages from the nose and swelling of the cheek and eyelid. The nasal cavity was filled with a dark red soft mass, which bled freely on palpation. Roentgenograms revealed a cloudy antrum. A radical operation on the antrum showed a dark brown bloody polypoid mass the size of a goose egg, which was growing from the naso-antral wall and had eroded the facial wall of the antrum near the internal angle of the orbit.

Worms' [126] patient had a nasopharyngeal fibroma, which recurred after an operation and was removed through a lateral rhinotomy opening. Prolongations of the tumor invaded the maxillary, ethmoid and sphenoid sinuses. The postoperative cavity was large, but a good cosmetic result was obtained.

A rapidly growing tumor of the ethmoid region in a man of 24 is reported by Bonnet and Perron.[127] It was diagnosed clinically as a sarcoma, but the biopsy was reported to show "inflammatory tissue." The frontal sinus was opened through an orbitolateronasal incision and found to contain glairy puriform material. The maxillary sinus was

123. Muta, T., and Matsunaga, H.: Pyocele der Kieferhöhle, Oto-rhino-laryng. **9**:710 (Aug.) 1936.

124. Leicher, H.: Pyocele des Siebbeins und der Stirnhöhle mit Mucocele des anderseitigen Siebbeins, Ztschr. f. Laryng., Rhin., Otol. **26**:426, 1936.

125. Tsuru, Y.: Ueber die Blutgeschwulst in der Nasenhöhle und den Nebenhöhlen, Oto-rhino-laryng. **9**:316 (April) 1936.

126. Worms, G.: Fibrome nasopharyngien à prolongement ethmoïdo-sphénoïdal, Ann. d'oto-laryng., March 1936, p. 273.

127. Bonnet, P., and Perron: Exophtalmie par tumeur de l'ethmoïde, Bull. Soc. d'opht. de Paris, February 1936, p. 111.

then opened and showed a fungoid mucosa and contained the same dark glairy mucus. The ethmoid mass was replaced by a tumor which looked like a malignant growth. It was exenterated and was found to have extended all the way back to the pterygomaxillary space into the orbit. Histologic examination revealed a vascular fibrous base presenting subacute inflammatory infiltration with lymphocytes and plasma cells, both interstitial and perivascular. There was no evidence of tuberculosis or carcinoma. The recovery was complete.

As usual, a number of cases of osteoma are reported. In Nowotny and Schüller's case,[128] which ended fatally, the condition was complicated by pneumocephalus and cerebrospinal rhinorrhea. The patient gave a history of epileptic attacks for many years and more recently suffered spontaneous hemiparesis with aphasia which lasted only a few days. Roentgenograms revealed the subdural accumulation of air over both hemispheres and a dense tumor at the base of the skull in the region of the cribriform plate. Two years later, owing to the severity of the epileptic attacks, the patient requested and received an intraspinal injection of air after the withdrawal of 70 cc. of fluid. Roentgen examination then showed all the cisternae and the ventricles well filled but the same accumulation over the hemispheres as before. Pressure symptoms followed, and the patient died. Autopsy disclosed the osteoma involving both ethmoid sinuses in the midline. There was a crack in the cribriform plate, through which air evidently had obtained entrance to the subdural spaces.

Benjamins and Verbeek's case [129] resembled the one reported by Baldenweek [130] in 1934. The patient had attacks of severe headache with unilateral paresis of the arm and the leg. Several attacks resembling jacksonian epilepsy were observed. There was a history of trauma in childhood. Roentgenograms showed a large frontal pneumatocele surmounting an osteoma, which seemed to have invaded the posterior wall of the frontal sinus. At operation the pneumatocele was found to be extradural over the frontoparietal area. There was a fistula in the anterior part of the osteoma, through which air could have passed from the sinus to the extradural space. A decompression was done, and the dura was sutured to the periosteum close to the tumor, which was removed several months later through a supra-orbital incision. It was found to have arisen from the interfrontal septum, rising rather high

128. Nowotny, K., and Schüller, A.: Subdural Pneumokephalus bei ethmoidalem Osteom, Röntgenpraxis **8**:107 (Feb.) 1936.

129. Benjamins, C. E., and Verbeek, F. A. L. J.: Pneumatocèle frontale interne et ostéome du sinus frontal, Ann. d'oto-laryng., September 1936, p. 881.

130. Baldenweek, L.; Mallet, T., and Jauveau-Dubreuil: Pneumatocéle frontale interne au cours de l'évolution d'un ostéome du sinus frontal, Ann. d'oto-laryng., July 1934, p. 657.

and extending into the cranial cavity but remaining extradural. The authors claim that the two stage procedure described prevented subsequent entry of air into the cranial cavity.

In Ježek's [131] case the condition was complicated by an infection of one frontal sinus and an orbital abscess. The tumor involved both frontal sinuses and one ethmoid sinus.

Escat [132] reports 5 cases and states that he is impressed by the frequent history of previous trauma. He states that the tumor is easily removed because of the spongy nature of the bone from which it arises. All his patients were successfully operated on. He claims that such a tumor is not infrequent and quotes from a thesis by Jean Causse, who listed 253 reported cases.

Laskiewicz [133] in 1 case found symmetrical osteomas of frontal sinuses which caused both eyes to be displaced downward and outward, with a marked widening of the nasal bridge. The growths were removed by the external route, and each measured 44 by 33 by 22 mm.

Matolcsy [134] cites authorities to show that osteoma may originate either from rests of cartilage or from periosteum. He reports a series of 16 cases. In 2 of them the growth definitely started from the orbital wall, and in a third case, though the growth apparently arose from the ethmoid bones, it was thought to be orbital in origin. Though osteoma of the upper jaw or the antrum is uncommon, the author observed 3 cases of this type. He points out that in such cases the growth may often be mistaken for carcinoma or sarcoma. He cautions as to postoperative care. Packing should be released slowly, removal beginning about the third day and being completed on the seventh or the eighth day. Otherwise, serious secondary hemorrhage may be encountered.

Sprowl's patient [135] gave a history of trauma. The growth was found attached to the roof of the anterior labyrinth of the ethmoid bone posterior and internal to the suture between the orbital plate of the frontal bone and the adjacent edge of the roof of the ethmoid sinus. It was pedunculated and easily removed. Histologic examination suggested origin from a fibrous process originating in the periosteum.

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131. Ježek, K.: Osteoma of the Frontal Sinuses, Časop. lék. česk. **75**:298 (March 6) 1936.

132. Escat, E.: A propos de cinq cas d'ostéome de l'ethmoïde, Ann. d'otolaryng., April 1936, p. 350.

133. Laskiewicz, A.: Ostéome géant ethmoidal bilateral chez une fillette de 14 ans, Rev. de laryng. **57**:175 (Feb.) 1936.

134. Matolcsy, T.: Ueber Nebenhöhlenosteome, Arch. f. klin. Chir. **184**:451, 1936.

135. Sprowl, F. G.: Orbito-Ethmoidal Osteoma, with a Report of the Case, Ann. Otol., Rhin. & Laryng. **45**:886 (Sept.) 1936.

Girard [136] attempts to show how a tumor diagnosed as nasopharyngeal fibroma of the Sebileau type may in reality be a true nasal growth arising from one of the sinuses. For a correct diagnosis it is necessary to find the point of origin of the growth, which in some instances is not easy. The tumor which he describes was a vascular mass filling one side of the nose and extending into the pharynx. He succeeded in destroying it with electrocoagulation up to the base, which was found to be in the vicinity of the maxillary ostium, the posterior wall of the ethmoid sinus and the anterior surface of the sphenoid bone. Several recurrences were observed, necessitating repeated coagulation. The importance of knowing whether the growth extends into one of the sinuses is emphasized from the therapeutic standpoint also, since in such cases it cannot be eradicated by coagulation alone. Extensive surgical operation is also required.

Among several cases reported by Davis [137] was 1 in which an osteoma was only partly removed through a lateral rhinotomy opening, operation being suspended because of severe hemorrhage. The tumor involved the nasal cavity and the ethmoid and frontal sinuses. Histologic examination gave definite evidence that the tumor originated from the cartilage.

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136. Girard, L.: Angio-fibro-myxome à base ethmoïdo-sphénoïdale à rapprocher du polype naso-pharyngien, Oto-rhino-laryng. internat. **20**:356 (June) 1936.

137. Davis, A. H.: Tumors of the Nasal Accessory Sinuses: Adamantinoma, Dentigerous Cyst and Osteoma, J. Oklahoma M. A. **29**:1 (Jan.) 1936.

(To be Concluded)

Abstracts from Current Literature

Ear

THE REACTION OF THE COCHLEAR NERVE TO DESTRUCTION OF ITS END ORGANS: A STUDY ON DEAF ALBINO CATS. HOWARD A. HOWE, J. Comp. Neurol. **62**:73 (Aug.) 1935.

In adult deaf albino cats the lesion is restricted practically exclusively to the structures of the cochlear duct, although there is also collapse of the sacculus, with concomitant degeneration of hair cells in its macula. There are complete disappearance of all hair cells and a varying amount of damage to their supporting elements. Nerve fibers and cells of the spiral ganglion appear practically normal. Counts of ganglion cells made on eighteen ears varied from 23,854 to 55,052. In normal ears the range was from 44,298 to 57,494. In albino kittens the count was as high as in the normal cat, although the hair cells were destroyed. Howe concludes that the cochlea has developed normally, that some unknown agent has caused, first, the disappearance of hair cells and, later, destruction of all the cells in the organ of Corti and that changes in the ganglion cells and nerve fibers have taken place later and are secondary.

ADDISON, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

ACUTE OTITIS MEDIA. A. CAMPBELL, Brit. M. J. **1**:788 (April 18) 1936.

Campbell outlines his experience and gives the results of his method of treatment, with especial reference to early paracentesis. Only 7 per cent of the patients who had early paracentesis required operation on the mastoid.

ROYSTER, University, Va. [AM. J. DIS. CHILD.]

MASTOIDITIS IN THE INFANT. M. GUILLEMOT and others, Bull. Soc. de pédiat. de Paris **34**:136 (March) 1936.

A discussion of the problems of diagnosis of mastoiditis in infants is reported. Some of the discussers are more radical than others, but on the whole all are agreed that the condition may be present without obvious signs of otitis media. Despite this fact and the fact that antrotomy in an infant is a relatively simple procedure, one should be careful not to subject an infant to an operation in which a normal mastoid antrum is opened. Better and more intensive roentgenographic examination is mentioned as offering a possible development for more accurate diagnosis in the future. BENJAMIN, Montreal, Canada. [AM. J. DIS. CHILD.]

THE FRONTAL LOBE AND EQUILIBRIUM. P. DELMAS-MARSALET, Encéphale **31**:15 (Jan.) 1936.

Experimental stimulation of the frontal lobe in animals yields the following conclusions: Cephalad to the primary cortical motor centers of the extremities there is a region electric stimulation of which evokes conjugate deviation of the eyes, rotation of the neck and incurvation of the vertebral column. These movements belong to the functions of static equilibrium of the body and orientation of the eyes. Traits which distinguish the activity of these centers from the primary motor centers are the higher threshold of electrical excitability, the slowness of the resulting movements, the associated movements evoked and the sensitivity to bulbocapnine. The global motor response resulting from stimulation of these centers resembles that from excitation of one labyrinth.

Experimental destruction of one frontal lobe in the dog results in curvature of the neck and trunk with ipsilateral concavity, and in mild disturbances, in coordination in the contralateral paws. There are turning movements toward the

side of the lesion. Muskens attributed these movements to lesions in the corpus striatum resulting from injury to the anterior cerebral artery. Delmas-Marsalet destroyed a small part of the frontal cortex. No abnormal movement resulted until cocaine was injected, whereon the typical curvature, turning movements and crossed ataxia appeared. The lesion was so minute that it could not affect the striate bodies. The crossed ataxia is always transitory, lasting a few days, after which, however, it can be revealed by injection of cocaine or by a labyrinthine lesion. Rotation with the animal's head in a horizontal position produced nystagmus in the same direction and of the same intensity as in the intact animal. But the usual postrotatory deviation of the head and turning movements appeared only with rotation toward the side of the injured frontal lobe and were absent with rotation in the opposite direction. Temporary suppression of the labyrinthine function by injection of cocaine into the middle ear ipsilateral to the injured frontal lobe intensified the curvature of the neck and body and the turning movement. It added ipsilateral ataxia to the crossed ataxia of the paws. Suppression of the contralateral labyrinth intensified the crossed ataxia. In both cases nystagmus was identical with that which occurs in the dog with the frontal lobe intact. Unlike the pigeon and the rabbit, the dog suffers no disturbance in orientation after unilateral destruction of the frontal lobe.

Destruction of both prefrontal lobes results in no turning movements or incurvation, if the lesions are symmetrical. If not, there is a slight turning toward the more injured side. With the animal at rest the trunk is transversely twisted. In walking the paws are held apart. Often the two scapular or the two pelvic limbs advance together. This, with oscillation of the trunk, results in an uncertain gait. Rotation gives the same results as in the normal dog, but the turning movements are feeble. Cocainization of the labyrinths gives the same result in these dogs as in normal animals, except that the turning movement is of increased intensity. These results cannot be explained as the "algebraic sum" of the lesions of the two frontal lobes.

In order to explain the peculiar intervention of the frontal lobe, complementary experiments were carried out. Section of the frontal segment of the corpus callosum resulted in none of the disturbances resulting from lesions of the frontal lobes. A unilateral lesion of the sigmoid gyrus gave only crossed paresis of the limbs with normal labyrinthine responses, except that cocainization of the contralateral labyrinth increased the paresis. Destruction of the head of the caudate nucleus gave the same results as destruction of the ipsilateral frontal lobe, except that hypodermic injection of cocaine did not intensify the turning movements. Destruction of one lenticular nucleus differed from that of the caudate nucleus only in that the turning movements were incomparably more intense and that cocainization of the contralateral labyrinth resulted in no turning movement in any direction. Section of one cerebral peduncle caused intense turning movements and curvature toward the lesion. Rotatory and labyrinthine responses have not been studied in connection with the latter lesion. Destruction of one cerebellar hemisphere resulted in ipsilateral dysmetria, hypotonia and ataxia similar to the crossed ataxia characteristic of frontal lesions and, when preceded by a lesion of the opposite frontal lobe, intensified the ataxia. Intravenous injection of bulbocapnine, prevented the appearance of turning movements and curvature after lesions of the frontal lobe, as well as that of similar reactions in the normal dog after rotation or cocainization of one labyrinth, and counteracted the effect of hypodermic injection of cocaine but did not interfere with nystagmus.

All these data suggest the existence of a connection between the prefrontal lobe and the crossed cerebellar hemisphere and between the prefrontal lobe and the ipsilateral vestibular nerve. Reactions apparently at variance with the hypothesis of the latter, such as turning movements toward the side of the injured frontal lobe following cocainization of the crossed labyrinth, can be explained as induced by the attitude of the body and neck. Such a reaction was demonstrated in a normal dog by maintaining its neck turned toward the right by means of a plaster jacket. Cocainization of the left labyrinth then resulted in paradoxical turning movements toward the right. The frontal lobe seems to be a postural center for the neck and trunk.

Clinically, the large mass of facts shows that disturbances of coordination resulting from lesions of the frontal lobe can be grouped under four main heads: cerebellar, labyrinthine and postural, praxic and gnostic. Disturbances of cerebellar origin correspond mainly to lesions of the crossed cerebellar hemisphere—dysmetria, adiadokokinesis, tremor, ataxia, spontaneous deviation of the limbs on the side opposite the lesion and lateropulsion away from the lesion—and occasionally to those of the vermis—ataxia and asynergia of the trunk and retropulsion. Disturbances due to labyrinthine involvement are reminiscent of those following a lesion of the ipsilateral labyrinth, namely, inclination of the head and body toward the lesion, spontaneous deviation of the index finger and of gait toward the side of the lesion and a tendency to deviate in the same direction after rotation. Bilateral adiadokokinesis and apraxia in walking are forms of apraxia and recall symptoms of disturbance in the corpus callosum. Gnostic symptoms are vertigo, false impressions of bodily displacement, lack of perception of certain bodily displacements and disturbances in spatial orientation and the postural image of the body. These symptoms can occur separately or in various combinations, which explains the great variability of syndromes of the frontal lobe.

Topographically there are three main syndromes: superficial, deep and mixed. The superficial syndrome is subdivided into three regional subheads: The pediculofrontal syndrome corresponds to a lesion of the foot of the first and the second frontal gyrus and comprises symptoms of involvement of the crossed cerebellar hemisphere in the pelvic extremity, for the first frontal gyrus, and in the scapular extremity for the second frontal gyrus. There may also be bilateral apraxia in erect walking. The mediofrontal syndrome corresponds to a lesion of the middle parts of the three frontal gyri and consists of ipsilateral labyrinthine symptoms and sometimes spatial disorientation. The telefrontal syndrome corresponds to a lesion of the most oral region of the frontal lobe and consists mainly of spatial disorientation. The deep frontal syndrome corresponds to a large central lesion of the frontal lobe, acting on the corpus callosum and even the opposite frontal lobe. Its symptomatology is not clearly delimited. It seems to include intense, massive, bilateral astasia-abasia and sometimes spatial disorientation, inversion of evoked deviation of gait following rotation and anteropulsion or retropulsion. A mixed frontal syndrome results from combinations of the preceding syndromes. It tends to bilateralization of the symptoms with unilateral lesions. This sketch of a classification, "far from constituting a formal law, pretends simply to translate a statistical frequency."

Many lesions of the frontal lobe do not result in any disturbance of coordination. This is sometimes due to concomitant lesions of the primary motor centers. In the absence of voluntary movement incoordination cannot be observed. More often, the absence of incoordination is due to compensation by other parts of the neuraxis. Scopolamine can make latent incoordination apparent, as cocaine does in the dog.

Architectonically, the pediculofrontal area is constituted by cortex type 1 of von Economo; the mediofrontal area, by cortex type 1 in the first frontal gyrus and by cortex type 2 in the second and third frontal gyri, and the telefrontal area, by cortex type 3. The telefrontal area resembles the region of the first temporal gyrus, which is believed to receive the vestibular path. This resemblance, with physiologic and clinical considerations, supports the hypothesis that the mediofrontal and telefrontal areas are connected with the vestibular path and the mediofrontal also with the cerebellum.

The connections of the prefrontal lobe involved in its function of coordination seem to be the frontopontile, the thalamofrontal, the pallidofrontal and the frontospinal tracts. The globus pallidus is probably a relay station for the ascending vestibular path. Serial sections of the neuraxis of a dog in which the anterior frontal decussation was destroyed showed ipsilateral degeneration in the centrum ovale, the segment of the corpus callosum joining the second, third and fourth gyri arcuati, the inferior part of the anterior segment of the internal capsule, a few fibers in the head of the caudate nucleus, a small bundle in the external capsule, part of the inferor zone of the posterior segment of the internal capsule, the lateral medullary lamina, the anterior part of the posterior and the lateral

nucleus of the thalamus, scattered fibers at the origin of the pes pedunculi and in the juxtanigral part of the pes, a few fibers in the medial geniculate body, the bundles ending in the pontile nuclei in the ventral level of the pons and scattered fibers in the anteror pyramid at the level of the medulla. The last-mentioned fibers follow the corresponding pyramidal tract through the first three or four cubic millimeters of the spinal cord. Atrophy of ganglion cells was observed in the lateral nucleus and the anterior part of the posterior nucleus of the thalamus and in the corpus hypothalamicum and, to a slight degree, in the putamen and the substantia nigra. LIBER, New York. [ARCH. NEUROL. & PSYCHIAT.]

RELATIONS BETWEEN THE COCHLEOVESTIBULAR SYSTEM AND THE OCULOMOTOR SYSTEM IN A CASE OF POSTTRAUMATIC PARALYSIS OF THE OCULAR MUSCLES. V. TANTURRI, Rev. d'oto-neuro-opht. **13**:509 (July-Aug.) 1935.

After an accident in which his head was crushed between two motor vehicles, Tanturri's patient complained of head noises, vague vertigo and diplopia. Examination revealed complex disturbances of the movements of both eyes, consisting of paralysis of both external rectus muscles and of upward and downward movements of the globe. In fixing on an object which was slowly displaced laterally, the eyes turned beyond the limit of the paralysis. There were, in addition, spontaneous irregular nystagmus toward both sides; bilateral hypo-acousis, with reduced bone conduction and concentric limitation of the auditory fields; minimal reactions to stimulation of the labyrinth; marked hypo-excitability in the caloric test, and normal reactions to the galvanic test.

The ocular paralytic syndrome may be localized with probability in the corpora quadrigemina. The puzzling question is whether the cochlear and labyrinthine phenomena were the result of peripheral or of central lesions. Ocular movements provoked by the fixation of an object which is moved slowly and reflex labyrinthine movements are of different nature. The preservation of provoked nystagmus in a case of paralysis of the ocular muscles does not mean certainly the existence of a supranuclear lesion, for in a case previously observed the cortical oculogyral stimulations were active and intervened to stop the nystagmus produced by labyrinthine stimulation. When reflex vestibular movements of the eyes are conserved and voluntary movements are lacking, it is logical to assume that the lesions of the oculogyral pathways are supramesencephalic. In the case cited, it was believed that the lesions were located in the posterior longitudinal bundle and that the indirect pathways traversing the reticulated system were intact. The validity of the belief of a number of writers that strabismus is of labyrinthine origin is placed in doubt by the investigations of Sommer and Tanturri. A number of observers have reported cases of ocular paralysis due to a lesion in the pons, and it is known that in animals interruption of the posterior longitudinal bundle causes ocular paralytic phenomena. Spiegel assumed that the vestibulo-ocular tract represents a common pathway for cortical and vestibular ocular movements. Bárány's assumption of a supranuclear center for the quick phase of nystagmus, located around the aqueduct and in the reticular formation, is not confirmed. According to Brunner, the lesions that abolish nystagmus are destruction of the ocular nuclei, destruction of the posterior longitudinal bundles and destruction of the longitudinal bundle of one side and a lesion of the bundle on the other.

The complexity and bilaterality of the ophthalmoplegia in the case reported exclude a simple lesion of the tip of the petrous process; the paralysis must be explained by a nuclear lesion. In lesions of the quadrigeminal bodies, difference in the size of the pupils has been observed, and Spiegel postulated a nucleus for pupillary accommodation to light, situated around the aqueduct. If the lesion extends downward toward the locus caeruleus or the medullary velum, disturbances of mastication, due to a lesion of the nucleus of the fifth nerve, are observed. The hypothesis that the vestibular lesions are peripheral cannot be excluded, because of: (1) dissociation in the labyrinthine tests; (2) the fact that hypo-excitability is usually observed after a peripheral lesion; (3) concomitance of cochlear phenomena, and (4) the fact that vestibular symptoms are rarely

observed in lesions of the corpora quadrigemina. On the other hand, there were complete absence of concomitant general phenomena (rotary vertigo and falling) and deviation to the left in walking (i. e., toward the side of the quick phase of nystagmus); both phenomena point to a central lesion. The question whether the cochlear impairment was peripheral or central in origin is discussed pro and con. Tanturri believes that after the traumatism small hemorrhages were formed at the level of the posterior corpora quadrigemina, which explains the ocular paralysis, that the cochlear and vestibular disturbances were due to either central or peripheral lesions and that, from a clinical point of view, the topographic diagnosis of these alterations is extremely difficult.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]

ISOLATED ELECTRIC STIMULATION OF THE TWO VESTIBULAR NERVES: DOUBLE CHRONAXIA ON EACH SIDE. G. BOURGUIGNON, Rev. d'oto-neuro-opht. **13**:781 (Dec.) 1935.

It has long been known that excitation of a single exposed semicircular canal in the pigeon by the use of bipolar electrodes produces an inclination of the head to the right or to the left, depending on the direction of the current. Bourguignon attempted isolated stimulation of one labyrinth in man by applying one small electrode in the ear and another to the mastoid of the same side. With the positive pole in the ear the head was inclined toward the side stimulated; with the negative pole in the ear the inclination of the head was toward the opposite side. In a subject in whom the eighth nerve on one side had been divided, no inclination of the head was obtained when the poles of the current were applied to the ear on that side; bipolar stimulation of the intact ear produced inclination of the head in one of the two directions, according to the direction of the current: stimulation with the positive pole in the ear produced the same vestibular chronaxia as binaural excitation with the positive pole on the sound side; the stimulation with the negative pole in the ear caused the same chronaxia as binaural excitation with the positive pole on the side of the sectioned nerve, indicating that stimulation was from the negative pole on the sound side.

In a normal man the chronaxia measured by the bipolar method with the positive pole in the ear is the same as that observed with the classic binaural stimulation; with the negative pole in the ear the chronaxia is from 10 to 20 per cent greater or less (depending on the subject) than that obtained by the classic method of binaural stimulation. "In man and in cats the vestibular chronaxias of the two ears are symmetrical in relation to the direction of the current, while in the rabbit they are symmetrical in relation to the direction of the stimulation." This difference is due to the different disposition of the eyes in the two groups: Man and the cat have binocular vision, and the rabbit has monocular vision.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]

LOCALIZATION OF SOUND BY A PERSON WITH ONLY ONE EAR. C. VEITS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **39**:94, 1935.

Veits describes tests of the capacity for localization of sound of a boy aged 13 who four months previously had undergone a labyrinthectomy on the right side and whose right facial nerve had likewise been destroyed. The results of the tests indicate the existence of a monotic localization of sound. The localization of the chief directions of the origin of sound is about as good in a person with only one ear as in a person with a normal hearing apparatus. To be sure, there are some "localization scotomas," which are probably the result of sound shadows caused by the head or the auricle.

EDITOR'S ABSTRACT.

THE PART OF OTITIS IN INFANCY. E. GYÖRGY, Orvosi hetil. **80**:143 (Feb. 15) 1936.

In infancy otitis media may cause not only local but also general symptoms. It may cause symptoms of dehydration. In this case incision of the drum is not

enough; antrotomy should be done. Antrotomy should be done also in cases of chronic otitis media, because the continued absorption of pus may poison the body permanently. GÖTTCHE, Budapest, Hungary. [AM. J. DIS. CHILD.]

Pharynx

TUMORS OF THE ORAL MUCOUS MEMBRANES. CHARLES F. GESCHICKTER, Am. J. Cancer **26**:586 (March) 1936.

Practically all tumors of the oral epithelium, both benign and malignant, are epidermoid, being derived from the lining cells of the mucous membrane. Ulceration, either traumatic or syphilitic, and leukoplakia or papilloma are frequent precursors of cancer. In 10 per cent of the cases studied there was a history of syphilis. Basal cell carcinoma occurs rarely on the intra-oral mucosa, and when it occurs it appears chiefly on the cheek or palate. Geschickter, while admitting that trauma is often a predisposing factor in the development of cancer, expresses the belief that it is not a leading factor.

Embryologic considerations determine localization of malignant degeneration to a considerable extent. In the majority of cases surgical treatment, consisting usually of electrocautery, was used, and the percentage of cures has not diminished since more routine block dissection of the regional lymph nodes has been discontinued. When the series of cases in which surgical treatment was employed was compared with a similar series in which treatment with radium had been given elsewhere, the end-results in a five year period were almost the same. It appeared that the prognosis was determined by the extent of the disease rather than by the treatment employed.

FOERSTER, Milwaukee. [ARCH. DERMAT. & SYPH.]

ALTERATIONS OF THE BACTERIAL FLORA OF THE TONSILS IN THE COURSE OF ROENTGEN THERAPY FOR CHRONIC TONSILLITIS. E. D. DUBOVY and N. M. GORDIAN, Fortschr. a. d. Geb. d. Röntgenstrahlen **53**:73 (Jan.) 1936.

Roentgen therapy produced a decrease in the number of persons whose throats harbored pathogenic organisms. In a group of fourteen children whose tonsils were large but who exhibited no associated symptoms of infection, pathogenic organisms were not recovered either before or after treatment. The experiment was entirely uncontrolled. MCCUNE, New York. [AM. J. DIS. CHILD.]

ABSCESS TONSILLECTOMY IN DIABETES. J. SCHUBEL, Ztschr. f. Hals-, Nasen- u. Ohrenh. **39**:427, 1936.

Schubel maintains that abscess tonsillectomy is not a serious intervention for an otherwise normal organism. On the contrary, observations on several hundred cases have proved that it is the method of choice. However, there remains the question whether this procedure is advisable also in case of a systemic disorder, such as diabetes. The author reports the history of a girl aged 17, who had been diabetic since the age of 14. She was brought to the author's clinic on account of a peritonsillar abscess that had existed for three days. She was in a precomatose stage, and the question arose whether the operation should be postponed and the diabetes treated first or whether an operation should be performed in spite of the existing precoma. Since postponement of the intervention involved the danger of tonsillogenic sepsis, it was decided to resort to abscess tonsillectomy with the area under local anesthesia. After the intervention the patient stated spontaneously that she felt greatly relieved. Then measures were taken to counteract the coma. They were successful, and the daily treatment of the tonsillectomy wound revealed that the healing process took a normal course. This case convinced the author that abscess tonsillectomy with simultaneously existing diabetes involves no greater risk than does a less extensive intervention that is done with the area under local anesthesia. EDITOR'S ABSTRACT.

Nose

INTERMITTENT DIPLOPIA PRECEDING INVASION OF THE ORBIT BY A MUCOCELE OF THE FRONTAL SINUS. JEAN SÉDAN, Rev. d'oto-neuro-opht. **14**:561 (Sept.-Oct.) 1936.

Sédan discusses the curious fact that invasion of the orbit and displacement of its contents by a mucocele of the frontal sinus are frequently not accompanied by troublesome diplopia and the further fact that when diplopia has been present before rupture of the mucocele into the orbit, it frequently disappears after such rupture. An illustrative case is reported. The explanation for the second phenomenon is that the diplopia is caused by paresis of the superior muscles of the orbit, lying in contact with a focus of osteitis. It is more difficult to explain the first observation. A possible factor is that the displacement of the globe is more horizontal than downward. It is known that horizontal displacement may be considerable without giving rise to diplopia.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]

DISEASE OF THE ACCESSORY CAVITIES IN INFANCY. HILDEGARD SCHÖNBERG, Arch. f. Kinderh. **107**:216, 1936.

Of 232 infants examined post mortem, 154 showed empyema of the middle ear, of the antrum of Highmore or of both. Of 76 infants who had had dyspepsia, 57 disclosed infections of these cavities. Another common observation in the infants who had had dyspepsia was that, in addition to parenchymatous clouding of the liver, they had more or less marked peripheral fatty degeneration of the liver. This raises the question whether the injury to the liver was a cause or a result of the nutritional disturbance. The most probable sequence is as follows: As the result of a cold there develops an infection of the accessory nasal cavities, which runs a slow course but eventually leads to injury of the hepatic parenchyma, which then produces nutritional disturbance.

CRANE, Chicago. [AM. J. DIS. CHILD.]

PARANASAL SINUSITIS IN CHILDREN. H. LEICHER, Med. Klin. **32**:273 (Feb. 28) 1936.

Leicher discusses the diagnosis, prognosis and treatment of sinusitis in children, without contributing information which may not be found in standard textbooks. He adds the followng table compiled from measurements which he made from roentgenograms and at operation and necropsy, but he does not say on how many persons these values are based.

Age	Dimension Measured	Maxillary Sinus, Mm.	Frontal Sinus, Mm.	Ethmoid Sinus, Mm.		Sphenoid Sinus, Mm.
				Anterior	Posterior	
New-born	Height	3-7	0	2-5	2-5	0-2
	Width	2-4	0	1-3	1-2	0-2
	Depth	7-12	0	2-5	3-5	0-3
1 year	Height	4-8	0	2-6	2-6	1-3
	Width	3-7	0	2-3	2-3	1-2
	Depth	7-18	0	2-7	3-10	1-4
2 years	Height	5-9	0-3	3-8	3-8	2-3
	Width	3-8	0-2	2-3	2-4	2-3
	Depth	9-20	0-2	3-7	3-10	2-5
4 years	Height	8-15	0-4	3-10	3-10	3-5
	Width	6-12	0-3	2-4	2-4	2-3
	Depth	15-24	0-4	3-8	4-11	2-5
8 years	Height	15-24	0-8	6-12	4-10	5-10
	Width	10-18	0-8	3-6	3-5	3-6
	Depth	20-30	0-5	5-8	8-18	7-12

DOOLEY, New York. [AM. J. DIS. CHILD.]

RELATION BETWEEN VASOMOTOR RHINITIS AND TUBERCULOSIS. K. M. MENZEL, Monatschr. f. Ohrenh. **70**:597 (May) 1936.

Menzel points out that in 1933 he directed attention to the fact that for 33 per cent of twenty-three patients with vasomotor rhinitis examination of the blood by Löwenstein's culture method gave positive results. In these patients the vasomotor rhinitis was generally the only symptom; at least there were no subjective or objective signs of tuberculosis. A subfebrile temperature was rarely present, but in some instances the anamnesis justified the assumption of a former pulmonary disorder. The examination of the lung revealed signs of former, apparently inactive, tuberculous processes. On the basis of these observations it was assumed that at least in a considerable percentage of cases of vasomotor rhinitis a tuberculous infection is a possible cause of the allergy. Further, the author investigated whether perhaps in the nasal mucosa itself tuberculous processes develop which might represent the etiologic factors of the allergic sensitization in vasomotor rhinitis. He made histologic studies on the mucous membrane of the inferior nasal conchae of five patients with vasomotor rhinitis. In one case he detected tuberculous changes in both sides of the nose. He gives a detailed description of this case. He admits that one case does not permit a definite conclusion regarding an etiologic connection between vasomotor rhinitis and the tuberculosis of the nasal mucosa; however, he thinks that the disappearance of the rhinovasomotor symptoms together with the tuberculous process indicates such a connection, as does also the considerable incidence of tuberculous bacillemia in patients with vasomotor rhinitis, which he mentions in the first part of the report. EDITOR'S ABSTRACT.

Miscellaneous

STUDIES OF HEMOLYTIC STREPTOCOCCAL INFECTION: I. FACTORS INFLUENCING THE OUTCOME OF ERYSIPELAS. C. S. KEEFER and W. W. SPINK, J. Clin. Investigation **15**:17 (Jan.) 1936.

The general mortality from erysipelas determined in a survey of the records of 1,400 cases at the Boston City Hospital was 16.4 ± 3.6 per cent. In this group the most important general factors influencing the mortality were age, debilitating disease and bacteremia. Mortality was highest in the patients under 2 and over 70 years of age. Erysipelas had the same seasonal incidence as other streptococcic infections and frequently began in an acute infection of the nasal passages with hemolytic streptococci. GUEST, Cincinnati. [AM. J. DIS. CHILD.]

IMPORTANCE OF THE SIGN OF VESTIBULAR DISHARMONY IN A CASE OF ABSCESS OF THE CEREBELLUM. L. LEVESQUE, F. BARRON and A. CHARBONNEL, Rev. d'oto-neuro-opht. **13**:186 (March) 1935.

The case reported was that of a child aged 5 years who during convalescence from bilateral mastoidectomy after an attack of scarlatina suddenly experienced fever, occipital headache and hyperextension of the neck. Associated with these symptoms was a disharmonious vestibular syndrome, consisting of nystagmus to the diseased side, deviation of the arms, Romberg's sign and lateropulsion in the same direction as the nystagmus; there was a slight but distinct cerebellar dysmetria, which of itself was not sufficient evidence on which to base a diagnosis of abscess of the cerebellum. On account of these two syndromes immediate exploration of the cerebellum was made, and an abscess was evacuated. Later, the deviation of the arms and the Romberg sign were changed in direction. Death occurred suddenly two months after intervention, from an undetermined cause. The association of the disharmonious vestibular syndrome was the deciding factor in the diagnosis. DENNIS, Colorado Springs, Colo. [ARCH. NEUROL. & PSYCHIAT.]

REMOVAL IN A MASS OF SUBACUTE ABSCESS OF THE CEREBRAL HEMISPHERES, WITHOUT DRAINAGE. C. VINCENT and M. DAVID, Rev. d'oto-neuro-opht. **14**:1 (Jan.) 1936.

A young woman was first seen in November 1934, with a syndrome of intracranial hypertension of six weeks' duration. Bilateral ventricular puncture and injection of air into the right ventricle, with subsequent roentgenography, revealed that the left lateral ventricle was not injected and that the right ventricle and the third and fourth ventricles were deviated to the right. A diagnosis of tumor of the left frontal lobe was made. A large frontal flap was raised, and a trocar was inserted at the anterior third of the third frontal convolution. At a depth of 4 cm., resistance was met, which was overcome and an abscess cavity entered, from which 20 cc. of pus was removed. It was decided to close the wound and wait until the condition of the patient improved and the wall of the abscess had become thickened, when the abscess would be removed *en masse*. Decompression and puncture of the abscess brought prompt and marked improvement in the patient's condition. In January 1935 the abscess was dissected out with electrocoagulating forceps; the cerebral cavity was lined with thin muscle fibers and a piece of fascia lata, and the flap of bone was replaced. Incisions in the dura and skin were completely sutured, without drainage. The abscess weighed 150 Gm. After operation recovery was uninterrupted. For a few days a marked local reaction occurred, consisting of raising the flap and voluminous edema of the forehead and eyelid, but this was controlled by daily spinal punctures. Union was by primary intention. Eight months later reexamination showed that the patient was in magnificent health.

This is the first instance of complete removal of a subacute abscess of the brain, although several times a chronic abscess with thick walls, which was mistaken for a tumor, has been dissected out. This method rests on two principles: First, in the great majority of cases an abscess of the brain is surrounded by a capsule which becomes progressively thicker, and, second, after the first phase of abscess of the brain has passed, the patient is the victim more of intracranial hypertension than of cerebral infection. The first statement is contrary to the opinion of otologists. The apparent contradiction is due to the fact that at the period when the otologist operates little capsule is present; if a period of from fifteen to twenty days were allowed to pass, the capsule would be present. Thanks to the effects of decompression and puncture of the abscess, one may wait without danger for thickening of the wall to occur. This method has since been applied in seven cases. Only one patient has died, and then not from infection. Vincent and David maintain not that certain abscesses of the brain should not be drained but that drainage should not be instituted indiscriminately in all cases of abscess of the cerebral hemisphere.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]